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BULLETIN NO. 1.

OCTOBER, 1912.

THE

Chestnut Blight Disease.

MEANS OF

IDENTIFICATION, REMEDIES SUGGESTED AND NEED OF CO-OPERATION to CONTROL and ERADICATE the BLIGHT.

ISSUED BY

THE COMMISSION FOR THE INVESTIGATION AND CONTROL OF THE CHESTNUT TREE BLIGHT DISEASE IN PENNSYLVANIA.

1112 Morris Building,
Philadelphia.

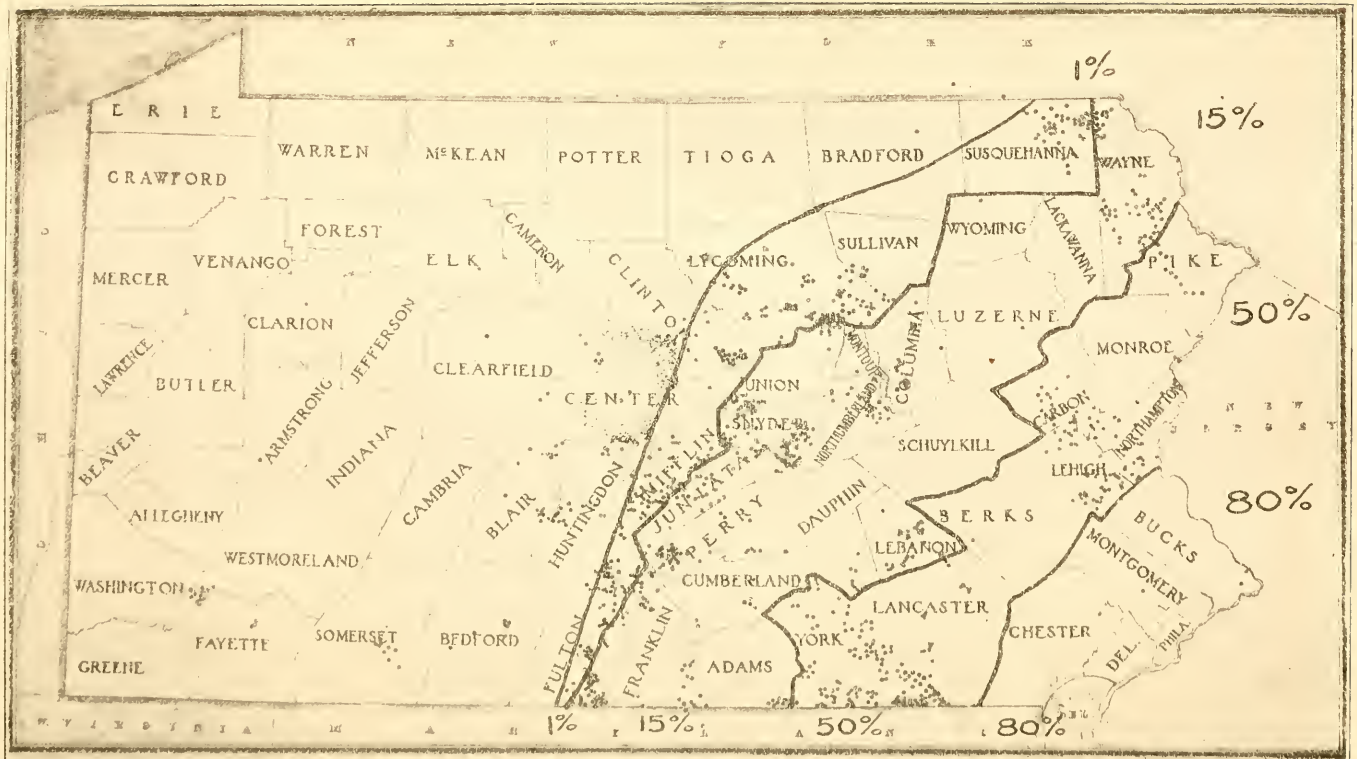
HARRISBURG:
C. E. AUGHINBAUGH, PRINTER TO THE STATE OF PENNSYLVANIA
1912.

NOTE.

The Commission for the Investigation and Control of the Chestnu
Tree Blight Disease in Pennsylvania was authorized by an Act
Assembly approved by Governor Tener, June 14, 1911.

This Commission, in collaboration with the Pennsylvania Depar
ment of Forestry, is to ascertain, determine upon and adopt the mo
efficient and practicable means for the prevention, control and erad
cation of a disease of the chestnut tree, commonly known as th
chestnut tree blight. It is authorized to conduct scientific investig
tions into the nature and cause of such disease, and the means
preventing its introduction, continuance and further spread. Th
Commission has power to establish, regulate, maintain and enfor
quarantine against the introduction and spread of such disease, an
from time to time, to adopt and prescribe such regulations an
methods of procedure as it may deem necessary and proper.

The Commission will cooperate with the owners of chestnut tre
to accomplish all of the purposes of the Act in every possible manne



Map of Pennsylvania showing estimated percentage of Chestnut trees affected by Blight

THE CHESTNUT TREE BLIGHT DISEASE.

THE DANGER

In 1904, Dr. H. W. Merkel first called attention to the disease now known as the chestnut blight, which was then killing the chestnut trees in the Bronx Zoological Park in New York City.

At least two reliable observers have reported that they found diseased chestnut trees on portions of Long Island, as early as 1893, which had every appearance of suffering from the blight. There are accounts of a general dying-out of chestnut trees in portions of the South as early as 1824, and again in 1860, 1862, and 1878. It is not known whether these troubles were due to a fungus, to the attacks of some of the well-known insect enemies of the chestnut, or to other causes.

During the summer of 1911, the authorities of the United States Department of Agriculture and the officials of various States investigated the present extent of the ravages of the Chestnut Bark Disease. It has radiated from New York as a center, and is now known to occur from New Hampshire and eastern New York to western Pennsylvania, Virginia and West Virginia. It is feared that the disease will sweep through and destroy the great chestnut forests of the South. The blight has virtually exterminated the native chestnut trees on western Long Island, and in southwestern Connecticut and northern New Jersey. An increasingly greater proportion of uninfected trees is found as the distance from New York City becomes greater. However, beyond the region of general infection there are centers of disease, sometimes of considerable extent, where all, or almost all, of the chestnut trees are seen to be hopelessly affected.

In Southeastern Pennsylvania, the disease has affected a very high percentage of the chestnut trees, large and small, and there is but little hope of saving many of these trees in this region from future destruction by the disease. The accompanying map of Pennsylvania shows the badly infected territory and where the infection is scattering, as far as is known.

BOUNDARY LINE

The western boundary of the blight in Pennsylvania may be shown approximately by a line drawn across the state from Susquehanna, in Susquehanna County, southwest to Waterville, in Lycoming County, thence to Orbisonia, in Huntingdon County, and southward along the Tuscarora Mountains, in Fulton County. East of this, the blight

may be expected to be more or less abundant in any locality. There are a few isolated infections beyond this line in the western half of the State.

THE LOSS

If we take into consideration only the commercial value of the timber products and nuts, it is safe to say that the blight has already caused a loss of $7,000,000 in this State. If we consider the value of the chestnut as a lawn and park tree and the value which such trees give to real estate, the financial loss is certainly not less than $3,000,000 more than that mentioned above. Yet this estimated loss of ten millions of dollars in Pennsylvania is small when compared with that which may occur throughout the entire country. Dr. Haven Metcalf, U. S. Department of Agriculture, estimates the present total loss caused by the disease as not less than twenty-five million dollars, ($25,000,000). The rapid progress of the blight through Pennsylvania and Maryland threatens the complete commercial extermination of the chestnut, unless the disease is conquered in a very short time. Few persons in eastern Pennsylvania realize how rapid has been the progress of the blight, but to be convinced of this fact, it is only necessary for one to become familiar with this disease and to closely examine the woods.

THE CAUSE

Many cases of supposed chestnut blight when investigated prove to be dead or unhealthy trees that have suffered from insect attack, lightning, or other common injuries. The real chestnut blight, more properly known as the chestnut bark disease, or the chestnut canker disease, is caused by a fungus, and is not, as some erroneously believe, the work of an insect. It affects, in varying degrees, all kinds of chestnuts, but pure strains of the Japanese chestnut have the power of resisting the disease to a remarkable extent. The chinquapin is killed by it, but, so far as is now known, living oaks and other trees are not attacked by this fungus, although it has been found on dead oaks and also on dead sumach.

THE BLIGHT

This fungus is a parasitic plant which resembles in many ways the moulds that form on decaying food. It grows however, in the interior of the bark and not on its surface, and feeds on living tissues instead of wholly on dead material, as do the moulds mentioned. It may be described as consisting of great numbers of tiny threads, which branch and grow in every direction through the bark. These threads, collectively known as the mycelium, are so small that a single one can be plainly seen only through a microscope; but they are so

numerous in the diseased bark that as mycelium, they may be seen with the naked eye, clustered together in the form of small, buff-colored, fan-like bodies when the bark is pared down. These fungal threads feed in the living tissues of the bark and eventually grow into the sapwood. Wherever they grow they cause the speedy death of the living cells of the trees. After a time the fungus completely girdles the tree, trunk or branch on which it is feeding. This causes the death of that part above the girdled portion, much as if girdled with an axe.

When the fungus has grown for a time in the chestnut bark, it develops on the surface of the latter a series of tiny, irregularly dome-shaped protrusions, (called pustules), each rarely larger than the head of a pin. These are the fruiting bodies which produce millions of sticky spores corresponding to seeds, and so tiny that they can be seen only by means of a powerful microscope. On smooth, young bark these pustules usually first appear as little reddish blisters beneath the surface of the bark. The tops of these blisters soon burst and the pustules appear as slightly raised spots covering the surrounding dark colored bark. On somewhat older bark the infected portions often, (though not always), become sunken as a result of the destruction of the underlying tissue. On small branches, especially young shoots, the infected portion is often abnormally thickened and cracked, and of a brilliant reddish or orange color.

Two forms of spores are produced, as in many other fungi. During and immediately following damp weather the mature pustules become somewhat enlarged, and thrust out slender twisted threads or "spore horns," one-sixteenth to three-eighths of an inch in length, and occasionally much longer. These are composed of the very minute summer spores held together by mucilaginous matter. At first, these threads are soft and jelly-like but they soon become hard, and, when dry, brittle. The number of spores in one of these "spore-horns" is so great that a single one, a quarter of an inch long, has been estimated to contain over five million individual spores.

The winter spores, (or ascospores), are more frequently produced during the fall and winter and are larger and less numerous than the summer spores. They are forced from the enclosing sacs in the mature pustules in damp weather and may be very important factors in spreading the disease.

DISSEMINATION

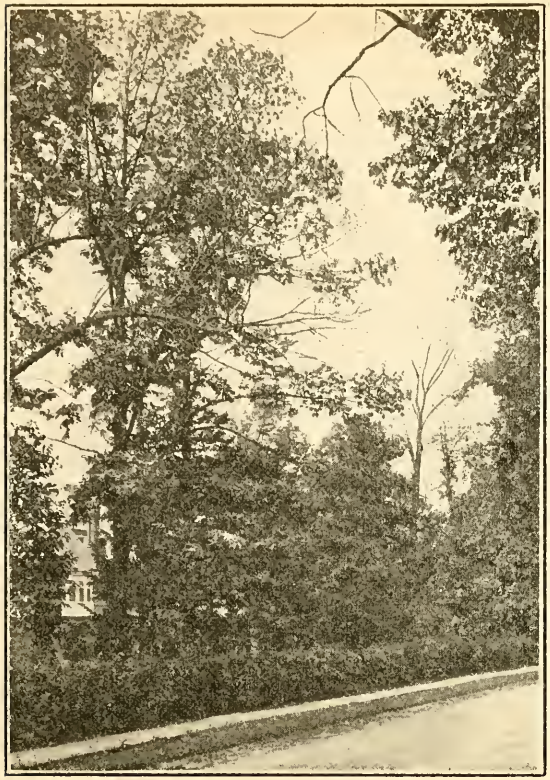
The blight usually appears first upon a tree here and there some miles ahead of the general infection. Where these instances of infection in regions ahead of the line of general advance are found, it may be that the sticky spores of the fungus have been carried on the feet of birds, particularly woodpeckers and other insectivorous birds. When these spores are deposited on healthy trees they are

easily washed down over the surface of the bark by rains, perhaps to lodge in a wormhole or other wound in the bark, where they can develop into minute plants. From these isolated trees as centers, the spores of these new plants can readily be distributed to surrounding trees by squirrels, birds, insects, etc.

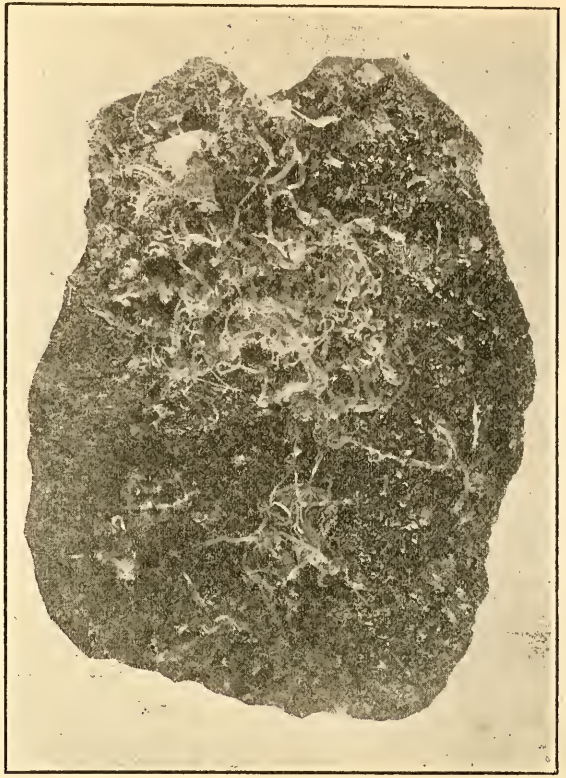
It is not yet definitely determined what agency is most concerned in distributing the spores, but it appears probable that insects are closely connected with the progress of the disease. The sticky spores are easily carried upon the legs and bodies of beetles and moths. So far as is known at present, in order to cause an infection, the spores must enter a wound or an abrasion in the bark, hence the boring insects are especially harmful on account of the holes they make through which the spores may enter. These holes are moist, and some of the spores which wash down the trunk are likely to enter these damp chambers and germinate. Ants, which are found crawling all over trees, are known to have eaten the spores from the surface of the fruiting bodies, and may thus have become effective agents for spreading the disease from tree to tree in an infected locality. Several other species of insects which affect chestnut trees appear abnormally abundant, and their relation to the spread of the disease is now being studied. Birds, as a factor in spreading the disease over longer distances, have already been mentioned, but they are possibly also effective in spreading the disease locally from tree to tree, by carrying the sticky spores on their feet from infected branches to those that are healthy. Woodpeckers, nuthatches, and other birds which bore into the bark for insects have been observed visiting the blight cankers. The wind blows many of the spores about, either mixed with dust or as fragments of broken "spore horns." The winter spores are forced out of the pustules into the air and the wind also is a factor in their distribution. When the summer spores are in the "horn" stage, or when fragments of a horn are carried to other trees, the gelatinous mass is readily dissolved by the first rain, and the spores washed down to lower positions on the tree where new infections are started.

Infection appears to take place only through a wound in the bark. The fungus feeds on the inner and middle bark and usually quickly girdles the trunk or branch on which it grows. A canker three inches in diameter has been observed to develop in five weeks. Small trees may die in a single season, and large ones are killed in from two to four seasons after the blight attacks them. In the meantime, half, or perhaps nearly all, the nearby chestnut trees may be expected to show the disease at some state of development.

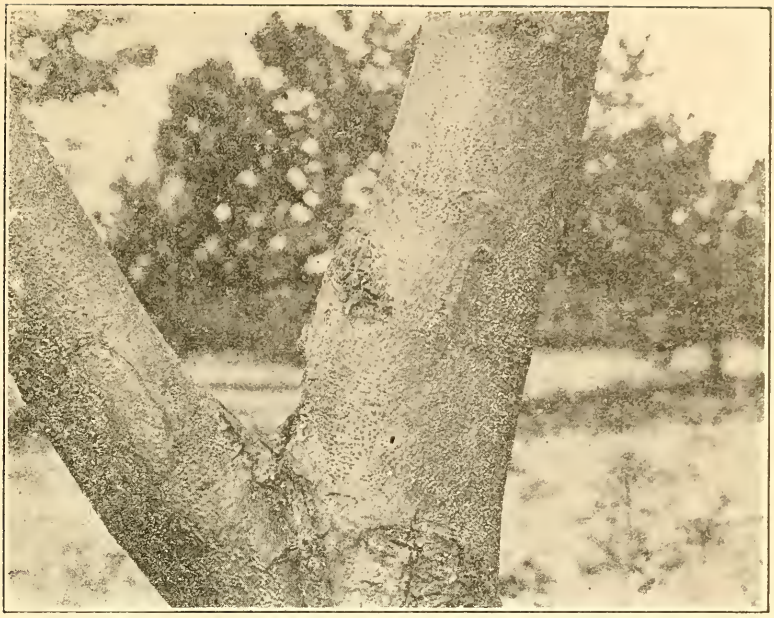
Diseased logs, cord wood, bark, etc., hauled along public highways or on railroads, may carry the spores to new localities. Shipment and planting of diseased chestnut nursery stock is another way in



Blighted and dead native chestnut trees seen along a popular drive near Philadelphia.



Section of infected bark showing summer spore threads.



A large area of disease pustules on a smooth-barked orchard tree.—*Photograph by Prof. Collins.*

Untreated orchard tree showing blight infection in upper branches.

which the disease may be widely scattered. Nursery stock shipped in Pennsylvania, must in accordance with law, be previously examined and tagged by a duly appointed agent of the Chestnut Tree Blight Commission.

The disease may be located and recognized by some, or occasionally all, of the following characteristics:

1. *Dead branches, usually with withered leaves clinging to them.* In the spring, prior to death, the leaves on the infected branches remain small and sickly looking, and gradually take on a yellowish tinge. When these leaves finally die, they have a peculiar wilted appearance. The burrs also remain small and undeveloped. On the branches attacked after the leaves have fully developed, the leaves assume their yellowish or reddish-brown fall colors. On trees killed by blight during the growing season, prior to September, both leaves and burrs usually remain clinging to the branches during the following winter, and at this time of the year are of great value in helping to locate infected trees. The wilted and dying, or dead leaves, are frequently the first intimation that the disease is present, and every owner of chestnut timber should carefully investigate the cause of dead branches in otherwise healthy trees, since these are the "danger signals" of this disease. Branches may occasionally be killed by worms of several kinds which burrow beneath the bark and girdle the tree or branch, or they may be killed by some physical injury.

2. *Cankers on diseased branches or on the trunk of smooth barked trees.* These cankers are areas of dead, discolored and sunken bark, often more or less broken by cracks or checks into the inner bark. Old, thick bark does not change in outward appearance until a year or more after it is diseased, when it begins to peel from the tree in shreds. Prior to shredding, thick bark which is diseased gives forth a peculiar hollow sound when struck. This is because of a space between the wood and bark caused by the decay of the inner bark. All hollow sounding bark is not necessarily diseased, however.

3. *Small wart-like eruptions, (pustules), which appear on cankers.* These pustules are of a bright sulphur, saffron, or orange-yellow which darken with age and at maturity are a dark brown. On old or furrowed bark the pustules form entirely in the crevices of the bark, and if numerous, appear as orange or yellow lines. Sometimes, especially in damp weather in summer, the yellow threads which exude from the pustules can be seen.

4. *The mycelium of the fungus which occurs in small, irregular fanshaped areas of a yellowish or buff color within the bark.* As further proof that a tree is diseased, shave off the surface of the suspicious looking bark, or cut slant-wise into it. If the cut shows the mottled color and characteristic whitish irregular fans of the fungous mycelium, the disease is present.

5. *Suckers or water sprouts, which develop at the base of the cankers, or at the base of the diseased tree.* They are frequently very numerous, and grow vigorously for one or two seasons, after which they are usually killed by the fungus.

However, to be absolutely certain, anyone suspecting the disease should mail generous samples of the dead bark, (taking care to include the area showing the pustules), to the Chestnut Blight Laboratory, Zoology Building, University of Pennsylvania, Philadelphia, Pa. for examination. To prevent spread of infection, each specimen should be wrapped in a separate paper or enclosed in a paper bag, or a tight box, and securely wrapped for shipment. With each specimen there should be information as to where, when, and by whom it was found, (including the post-office address of the sender.) In regions where the disease is just appearing, much assistance can be given to the Chestnut Tree Blight Commission by reporting it immediately and by sending specimens of suspected cases as directed above.

TREATMENT OF INDIVIDUAL TREES

Experience has shown that it is difficult to save individual trees after they have been attacked by blight. By special treatment of individual trees, it is possible to greatly prolong their lives, or perhaps save them, if the disease has not advanced too far when treatment begins. The expense is greatly increased and the chances of success are much more remote with large or old trees and particularly borer infected trees. The details of the treatment of orchard and shade trees is given in another circular, which may be had upon application to the Commission.

THE REAL REMEDY

The only efficient means of combating the disease, so far as known, is to cut down diseased trees and burn the infected portions, since the spores and most of the fungal threads are in the bark; if the diseased trees are cut down, barked, and all of the bark carefully burned, and a strict watch kept for new cases of infection as they occur, the disease will very probably be held in check. Great care should be taken to burn all of the diseased bark from the infected trees in order to destroy any infection that may be present.

In case the infection is on branches of trees of small size, it is better to cut out the diseased portion and burn it entirely than to waste time in saving the wood by peeling the bark. It is a good plan to burn the refuse over the stump of the infected tree to prevent possible future infection from this source. Stumps which have not been burned should be completely peeled of their bark, and this should be burned on nearby brush heaps. Even where perfectly healthy chestnut trees are cut, it is recommended that these stumps

be peeled, since it has been found that many cases of infection in sprouts originate from the bark of such old stumps. By destroying the bark on stumps, and by promptly burning such portions of trees as are not utilized, the insects which commonly breed in such material are prevented from becoming abundant, and thus perhaps causing a more rapid spread of the blight. The trees should be barked immediately after they are felled and the bark and brush burned, without being moved further from the stump of the felled tree than is absolutely necessary, since this moving always causes a scattering of spores, thus spreading the disease more widely. It is recommended that the brush and debris on the ground be cut and piled, prior to felling the diseased tree, in order to facilitate the complete cleaning up of the diseased bark and branches after felling. That such work may be successful, however, it is necessary that every owner of chestnut timber follow this plan of cutting the infected trees and burning the bark as soon as they are found. A single infected woodlot will re-infect surrounding woodlots, no matter how carefully they are treated.

The Commission has established a quarantine line to prevent the further westward spread of the disease. Spot infections are found some miles in advance of the main line of infection. In a prompt removal of these spot infections as they appear lies the hope of protecting the timber in these localities and to the west. It is quite important that the people learn to know the characteristics of the disease, so that new infections may be discovered and removed before the disease has spread generally.

UTILIZING CHESTNUT TIMBER

The blight problem in the southeastern part of the State, (see map), or where the percentage of infection is very large, is mainly one of utilization of the diseased trees. The advice given to owners is essentially this:—Learn to recognize the blight and keep thoroughly posted on the subject. Examine your chestnut timber thoroughly and frequently. If you have timber that is infected, arrange to market it at once, because a tree infected with the blight will die and the lumber rapidly deteriorates after the tree is killed. Trees fit for telephone and telegraph poles are not usually accepted for this purpose if they have been affected with blight for more than one season. Cut all trees that are at all infected. It would be wise to burn the bark that is infected with the disease, and also the bark from the stump, to prevent its spread to your own and your neighbors' healthy timber. Be very careful to extinguish your fires. Try to get your woods in a better condition for future growth. Try at least to keep your timber free from this disease, and interest your neighbors in doing

the same. Write to the Department of Forestry at Harrisburg, Pa., for valuable information regarding the planting and management of your forest lands.

It is believed by many that extremely dry or cold and unfavorable weather conditions have favored the growth of the fungus, and that it will decline again naturally. It is also possible that some medicinal remedy for the blight will be found for saving valuable individual trees. No evidence, however, has yet appeared that the disease is being checked through natural agencies, nor has any better or cheaper method of control been proposed than the simple one of cutting out and burning all the infected material, and in this way destroying the sources of infection. Practical demonstrations of the cutting-out method have given encouraging results, and strengthen the belief that the bark disease may at least be controlled, if not eradicated by it, provided the owners of diseased trees in the region of scattered infection co-operate in applying this measure promptly, and continue to do so as the new infections appear. The co-operation of all owners is the end to be desired. If each owner took care of his own trees, the fight would be already won. Do your part and explain the disease and consequences to your neighbors and friends. The Pennsylvania Chestnut Tree Blight Commission stands ready to give you any help that it can.

DISPOSAL OF PRODUCTS

Logs from infected trees may be converted into lumber, ties, cord wood, etc., after the bark has been removed from the diseased portions. Telephone poles, posts, etc., from diseased trees are not likely to be a source of danger in spreading the fungus, provided the bark has been removed. Much valuable material on the utilization of chestnut has been compiled by the Commission for the benefit of timber owners. If interested, write for full particulars.

THE LAW

Pennsylvania is the first State to attempt systematically to check the progress of the blight. On June 14, 1911, Governor Tener signed an Act which was passed by unanimous vote of both houses of the Pennsylvania Legislature. The act provided for the creation of a commission of five members, and gives them complete authority to attack and destroy this disease by whatever method they may adopt. It provides an appropriation of $25,000 for scientific investigations, and $250,000 for field work. This law provides that the Commission shall ascertain and adopt the most efficient and practical means for the prevention, control and eradication of the chestnut blight. It has the power to enforce quarantine against the disease. If the

owners of chestnut trees, when notified to remove the diseased specimens, refuse to co-operate with the Commission, it is fully empowered to do this work at the expense of the owner. (See note).

The Commission began its war on the blight in the latter part of July, 1911, by placing in the field a force of scouts to locate the diseased trees. During the present summer of 1912, the Commission has in its employ about two hundred field agents and scouts to locate infected trees, and see that they are removed under the proper conditions.

A quarantine on chestnut stock was declared which prohibits the shipment of nursery stock not bearing the Commission's tag of inspection. This certificate means that the stock has been inspected in the nursery rows, and again after it has been dug. Diseased trees are destroyed, and those which are apparently healthy are immersed for several minutes in Bordeaux mixture or lime-sulphur wash, and are then tagged by an inspector. Only a comparatively small amount of chestnut stock was shipped by the nurseries during the past fall.

Group of delegates and guests at the Chestnut Bark Disease Conference, Harrisburg, Penna., February 20-21, 1912.

THE CONFERENCE

Called by the Governor of Pennsylvania to Consider Ways and Means for Preventing the Spread of the Chestnut Tree Bark Disease

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THE CAPITOL

Chamber of the House of Representatives

HARRISBURG - PENNSYLVANIA

FEBRUARY 20 and 21, 1912

Stenographic Report of Proceedings of the Conference

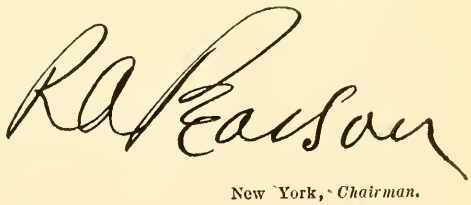
Reported by GUILBERT & LEWIS
519 Land Title Building
Philadelphia, Pa.

HARRISBURG:
O. E. AUGHINBAUGH, PRINTER TO THE STATE OF PENNSYLVANIA
1912.

FOREWORD.

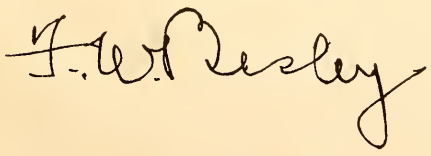
The following report of the proceedings of the Harrisburg Chestnut Blight Conference is distributed with the compliments and best wishes of the State of Pennsylvania. The numerous papers and the discussions thereon contain many new and valuable ideas. It is believed that the ultimate worth of the Conference will lie in the fact that it brought home to the eastern United States the truth concerning a most serious tree disease, and started discussions and a new trend of thought which must evolve real benefit for the whole people. If the Conference can produce a better understanding and higher appreciation respecting the value of trees, and of one tree in particular, its calling will have been of great public benefit.

The officers chosen by the meeting take this last opportunity of expressing to the Governor, the Chestnut Tree Blight Commission and the Delegates from the States, their sense of high appreciation for the honor conferred upon them in being invited to preside over the deliberations of the Conference. They also have hopes that information may be found in the following pages which will incite greater interest in the earnest work now being undertaken in Pennsylvania and other States to prevent the further spread of this serious and destructive Chestnut Bark Disease.



New York, *Chairman.*

Pennsylvania,



Maryland,

Secretaries.

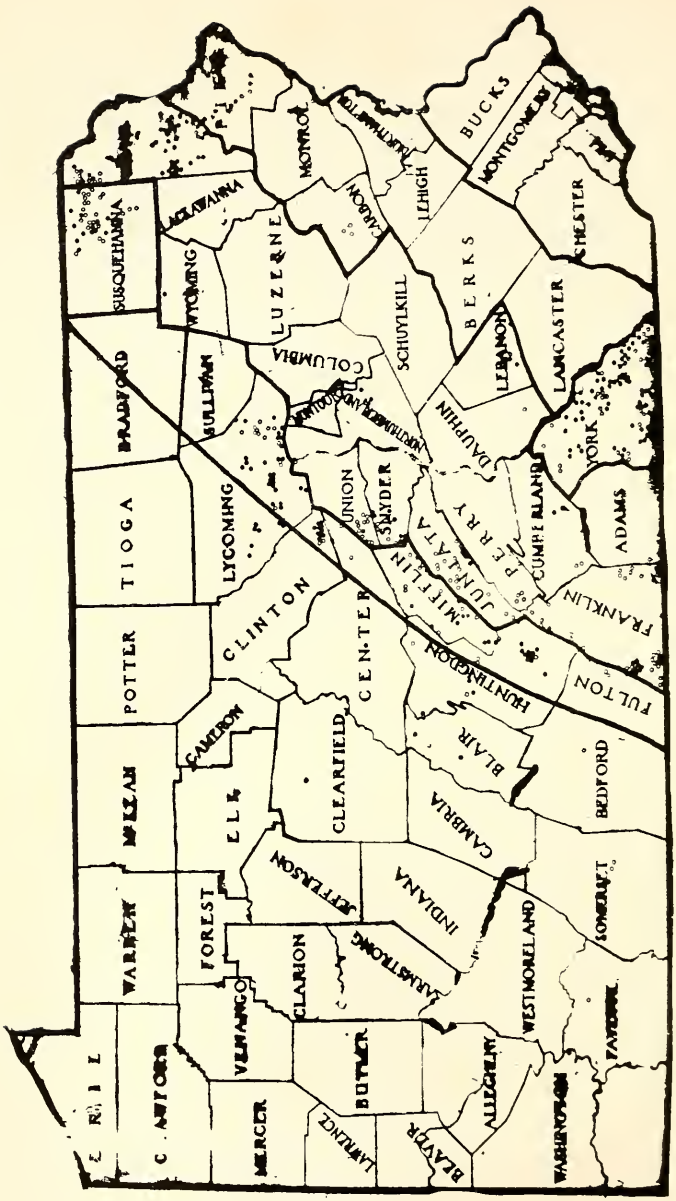
OFFICIAL CALL FOR CONFERENCE.

The Official Invitation for the Chestnut Tree Bark Disease Conference, issued by the Governor of Pennsylvania.

The Governor of Pennsylvania cordially invites you to be present at the Capitol in Harrisburg on the 20th and 21st days of February, A.D. 1912, to participate in a Convention called for the purpose of considering the danger presented by the prevalence and spread of a fungous disease of the wild Chestnut Tree, known as the Chestnut Bark Disease, and the methods to be pursued in accomplishing its possible control.

Executive Department, Harrisburg,
January 25th, 1912.

An early and, if possible, a favorable reply to the Secretary of the Pennsylvania Chestnut Tree Blight Commission, Mr. Harold Peirce, Room 1112, Morris Building, Philadelphia, will be appreciated.



Map of Pennsylvania Showing Infected Zones and Percentage.

1. Bucks, Montgomery, Chester, Delaware and Philadelphia counties, 80 per cent. 2. Pike, Monroe, Carbon, Northampton, Lehigh, Berks, Lancaster and York counties, 50 per cent. 3. Wayne, Lackawanna, Wyoming, Luzerne, Columbia, Montour, Northumberland, Union, Snyder, Juniata, Perry, Dauphin, Schuylkill, Lebanon, Cumberland, Franklin and Adams counties, 15 per cent. 4. From the western boundary of these counties to the quarantine line indicated on the map, the infected trees are estimated at 1 to 5 per cent.

THE PENNSYLVANIA CHESTNUT TREE BLIGHT COMMISSION.

The call issued by the Governor, in which he urged the importance and necessity for prompt and concerted action in combating the Chestnut Bark Disease, included the following statement:

"In 1911, the Pennsylvania State Legislature passed a bill authorizing the Governor to appoint a Commission of five citizens for the purpose of thoroughly investigating the Chestnut Tree Bark Disease which is rapidly destroying the chestnut trees of the Commonwealth. The Act placed an appropriation of $275,000 at the disposal of the Commission for the investigation and scientific study of the problem, and more specifically to ascertain the exact extent of the blight, and to devise ways and means through which it might, if possible, be stamped out.

The Commission was appointed in June, 1911, and, after organization, began its work immediately by sending a large force of experts into the field. The reports of these experts together with the results of the work of the pathological staff, will, among other matters, be presented for discussion to a Convention called by the Governor to assemble at Harrisburg, February 20th, 1912.

In order that the other States not yet touched by the blight, but certainly in its line of advance, may realize the seriousness of the situation, the Governor, who is much interested, has called this Convention for a consideration of ways and means, in the hope that the States may be aroused to action and be ready to meet the invasion at their borders. Pennsylvania's problem is now or soon will become the problem of Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Tennessee, Kentucky, West Virginia, Ohio, Indiana and Michigan. Active co-operation of the States is essential. The attendance of a large number of Delegates is respectfully urged."

COMMONWEALTH OF PENNSYLVANIA

PROGRAMME

of

THE CONFERENCE

Called by the Governor of Pennsylvania
to Consider Ways and Means

for

PREVENTING THE SPREAD

of the

CHESTNUT TREE BARK DISEASE

February 20 and 21, 1912

THE CAPITOL

Chamber of the House of Representatives

HARRISBURG - PENNSYLVANIA

An office for registration and information will be opened in one of the ante-rooms of the House of Representatives, and it is earnestly requested that all delegates and guests will promptly register.

PROGRAMME

OPENING SESSION

Tuesday, February 20, 2 o'clock P. M.

ORGANIZATION OF THE CONFERENCE.

1. *Call to Order and Address of Welcome to Delegates and Visiting Friends, by the Honorable John K. Tener, Governor of Pennsylvania.*

   Election of Permanent Chairman for the Conference.

   Election of Two Secretaries.

   Designation of Official Reporters.

   Appointment of a Committee on Resolutions.

2. *Responses to the Governor's Address by Delegates on Behalf of the States Represented.*

3. *"Historical Review and the Pathological Aspects of the Chestnut Bark Disease."*
   A discourse and illustrated lecture by Dr. Haven Metcalf, U. S. Department of Agriculture, Washington, D. C. (Dr. Metcalf's paper will summarize the record of work to date, and present the leading pathological features of this tree disease.)

   Many of the lantern views will be shown for the first time, having been especially made for this occasion.

4. *"Can the Chestnut Bark Disease be Controlled?"*
   By Prof. F. C. Stewart, N. Y. Agricultural Experiment Station, Geneva, N. Y.

5. *"How Further Research May Increase the Efficiency of the Control of the Chestnut Bark Disease."*

   By Prof. W. Howard Rankin, Cornell University, Ithaca, N. Y.

6. *"Recent Notes on the Chestnut Bark Disease."*

   By Prof. H. R. Fulton, Division of Pathology, Pennsylvania State College.

7. *"The Possibility of a Medicinal Remedy for Chestnut Blight."*

   By Dr: Caroline Rumbold, in charge of the Pennsylvania Chestnut Tree Blight Commission's Laboratory.

8. *"Treatment of Individual Trees,"*

   By Prof. J. Franklin Collins, U. S. Department of Agriculture, Washington, D. C.

9. *General Discussion.*

EVENING SESSION

Tuesday, February 20, 8 o'clock, P. M.

1. *"Chestnut Culture."*

   An illustrated lecture by Prof. Nelson F. Davis, of Bucknell University, Lewisburg, Penna. In this lecture Prof. Davis will exhibit the value of the chestnut trees as a source of food (nuts), and outline the progress made in the new American industry, chestnut cultivation.

   The insect enemies of the chestnut, and the methods of controlling them will be shown.

   Many of the views have been especially prepared for the occasion, and will be shown for the first time.

2. *General Discussion.*

MORNING SESSION

Wednesday, February 21, 9 o'clock, A. M.

ERADICATION AND CONTROL OF THE CHESTNUT BARK DISEASE.

1. *"The Pennsylvania Programme."*
   By Samuel B. Detwiler, Executive Officer of the Pennsylvania Chestnut Tree Blight Commission.

2. *Reports by State Foresters,* or other officials of States represented, on the present extent of the bark disease and estimate of the present and possible future loss.

3. *"Chestnut Blight and the Future of our Forests."*
   By Dr. H. P. Baker, Department of Forestry, State College, Penna.

4. *"Chestnut Blight and Constructive Conservation."*
   By Dr. J. Russell Smith, Professor of Industry, University of Pennsylvania, Philadelphia, Pa.

5. *Open Discussion of the Problems Presented.*

AFTERNOON SESSION

Wednesday, February 21, 2 o'clock, P. M.

1. *Presentation of the Report of the Committee on Resolutions.*

2. *General Discussion.*

Adjournment.

In addition to the above stated papers on the advance programme, others were read or formally presented as follows:

1. A paper on the "Botanical History of *Diaporthe parasitica* and Allied or Identical Fungi," by Prof. W. G. Farlow, of Harvard University; read by Prof. G. P. Clinton.

2. A paper on the "Relation of Insects to the Chestnut Bark Disease," by Dr. A. D. Hopkins, of the Bureau of Entomology, U. S. Dept. of Agriculture, Washington, and read by him.

3. A paper entitled "Chestnut Blight and its Possible Remedy," by Mr. W. M. Benson, of the Oak Extract Company, Newport, Perry Co., Pa.

4. A paper entitled "The Field Work of the Chestnut Tree Blight Commission," by Thomas E. Francis, Field Supervisor of the Pennsylvania Chestnut Tree Blight Commission.

5. A paper entitled "A Report on Scout Work on the North Branch of Bald Eagle Mountain, between Sylvan Dell and Williamsport, Lycoming county, Pa.," by Hugh E. Wells, Field Supervisor of the Penna. Chestnut Tree Blight Commission.

Conference for Preventing the Spread of the Chestnut Tree Bark Disease.

OPENING SESSION

Tuesday, February 20, 1912, 2 o'clock, P. M.

CALL TO ORDER AND ADDRESS OF WELCOME TO DELEGATES AND VISITING FRIENDS, BY THE HON. JOHN K. TENER, GOVERNOR OF PENNSYLVANIA.

GOVERNOR TENER: Gentlemen, the meeting will please be in order.

Let me say at the outset, speaking for this Commonwealth and less for myself personally, that we are gratified indeed at the splendid representation here to-day, bearing testimony to the great interest manifested in the work at hand.

I know that many of you have come from afar, many of you at great inconvenience and certainly at expense to yourselves or to the State or Association that you represent, in order that you might meet with us here, in the Capital City of Pennsylvania, to discuss and to consider seriously the objects and the purposes of this meeting.

It is not my purpose to enter into an extended discourse upon the subject of the chestnut tree blight or bark disease, but rather to extend just a word of welcome to you, on behalf of our Commonwealth and our city, and also to suggest what might be proper for your consideration at this time; to go over briefly the extent of this disease in the area it now covers; what it means to us if it spreads farther, and what it has meant to us; the value of our chestnut trees, and a suggestion of what I hope

you may be able to arrive at before you leave us. We know that in conventions, we cannot exercise any governmental function; yet we want this to be something more than a "resolve to resolve" meeting, and we hope that something really tangible will result from it. I have noted just a few things which, as I stated before, I would like to have you consider in your deliberations:

This Conference has been called for the purpose of obtaining all possible information concerning the best methods of fighting the destructive fungous disease known as the chestnut tree bark disease or the chestnut tree blight, which was first detected in the neighborhood of New York City about eight years ago, and has since spread to the Northeast as far as Eastern Massachusetts, and to the Southwest as far as Central Pennsylvania, Maryland and Northern Virginia.

This tree disease is virulent in character. To date, no specific remedy to be applied to individual trees is known.

It seems almost unthinkable that a disease of this character should have invaded so large an area and that no means of preventing its spread is yet at hand. Unless this disease be stopped by concerted action among the States, it is certain that within a few years very few living wild chestnut trees will be found in America. It is, therefore, entirely in accord with the American spirit that we make every effort to destroy or check the advance of this blight.

The value of the standing chestnut stock to-day in America is enormous. In Pennsylvania alone, the wild chestnut tree is found native throughout the State, and in its southern counties is the principal remaining forest tree. The value of this tree in the State of Virginia is reliably conceded by competent authority to be not less than thirty-five millions of dollars. I believe that here in Pennsylvania, by a very conservative estimate, placing a valuation of fifty cents upon each tree in our woodlands, which you will admit is a very low estimate, the value of the wild chestnut trees is at least forty millions of dollars.

The best chestnut in the world is still standing in the mountains of North Carolina, West Virginia, Eastern Kentucky and Tennessee. The chestnut stock of the future must necessarily be drawn from these states. To date, the blight has not reached

that region, but is steadily tending in that direction. This tree is also of great value in Ohio and the remaining Atlantic Seaboard States, and by reason of the all too prevalent forest destruction going on, the tree can ill be spared; much less its value wasted, as it largely will be, should the remaining chestnut stock be attacked.

The destruction of the wild chestnut trees in New Jersey, in Southeastern New York, Western Connecticut and Massachusetts and Southeastern Pennsylvania is marked to be complete.

The industries depending upon the wild chestnut tree for their support are of large proportions and great value. Every part of the tree is valuable for making tannic acid, used in the tanning industry. Telegraph and telephone companies depend mostly upon this tree for their stock of poles. The railroad companies are largely dependent upon it for their best railroad ties. The nuts are no inconsiderable part of this valuable product. Many thousands of men are employed in the industries depending upon the saving of the wild chestnut tree, and many other thousands of real estate owners will find their land values seriously affected should the tree ultimately be destroyed.

Two great facts to be borne in mind are, *first,* that the plague is with us and it must be reckoned with; and *second* that harmonious action and complete co-operation among all the interests involved, as well as the governments of the various states, can and will be the only means of checking this disease, if it can be checked. We are not so much concerned with its origin as we are with its presence and effects. While its botanical history and pathology are of importance, the real thing is preparedness to repel the invader, using every means known to science and practical experience.

It is, therefore, to be hoped that this aspect of the problem will be thoroughly taken hold of and discussed from every point of view, that concerted action will be immediately inaugurated, and no effort left unemployed that might produce desirable results. The time to act is now, and not after the scientific world has more fully worked out the history and pathology of the disease. Present day practical measures may well be aided by scientific inquiry, but the one by no means must wait upon the

other. It was because of Pennsylvania's realization of the importance of this work that the Legislature, at its last session enacted a bill creating a commission and defining the duties of that commission, as well as appropriated an adequate amount to carry on the work. Without reviewing that bill in its full text, it might be said that the proposed Commission was given the direction to seek out and destroy this disease. As Admiral Dewey, you remember, at about the outset of our war with Spain was directed by President McKinley and the Cabinet to seek out the Spanish fleet and destroy it, so it might be said that the only direction given this Commission was to find this dread chestnut bark disease, and destroy it.

That Commission has been organized, and this State is indeed fortunate in being able to command the services of such splendid men, such capable men as Messrs. Sargent, Peirce, Craig, Bodine and Ely, who have gone about their work with the determination to do all that is possible to bring about the desired results.

Were the cause of this disease known, and did we know how to combat it and how to destroy it, a meeting of this kind would be unnecessary; but we do know something of its ravages, how it attacks the trees, and now we are here to consider how we shall blot it out; how we shall arrive at the source of it, if possible, and then blot out the disease completely.

I am prepared now to consider a motion looking to a proper organization of this convention for the carrying out of its work, and for the proper recording of your deliberations to-day.

MR. HAROLD PEIRCE: I would nominate, as permanent chairman of the Conference, Dr. R. A. Pearson, former Commissioner of Agriculture of the State of New York, and as secretaries, Messrs. F. W. Besley, of Maryland, and Samuel B. Detwiler, of Pennsylvania.

THE GOVERNOR: You have heard the motion. The question is upon the election of Mr. R. A. Pearson, former Commissioner of Agriculture of the State of New York, as chairman of this Conference, and Messrs. F. W. Besley, of Maryland and S. B. Detwiler, of Pennsylvania, to serve as secretaries of this Conference.

The motion was put and unanimously carried.

THE GOVERNOR: Mr. Pearson is unanimously elected chairman, and Messrs. Besley and Detwiler are unanimously elected secretaries. I would suggest, gentlemen, for the complete organization for the transaction of your business, that some one be selected or designated to report the proceedings of this convention.

MR. I. C. WILLIAMS: I suggest the name of Mr. Victor G. Marquissee, who is here prepared to report the proceedings of this convention.

THE GOVERNOR: Without objection, the gentleman named in the motion will report the proceedings of this Convention. I now take very great pleasure in presenting to you, and calling to the Chair, the Chairman whom you have elected, Mr. Pearson, of New York . (Applause).

Mr. Pearson took the chair.

THE CHAIRMAN: Governor Tener, Ladies and Gentlemen: I appreciate that it is a great honor to be asked to preside over your deliberations. I accept the honor, and thank you for it, with appreciation also that it carries with it great responsibilities, for this is an important Conference. It is important because of the great commercial interests involved, and it is also important because of the intricate scientific questions that are involved. That its importance is well recognized could not be better shown than by the fact that the Governor of this great Commonwealth has called this Conference together, that it meets in these splendid quarters, and that this State has taken the lead in providing for practical, efficient work to be done in checking the ravages of the chestnut blight, through the efforts of a special Commission, the competency of the members of which is recognized not only in your State, but in many other States as well, where the work which they have begun has come to be known.

Four months ago we held in the Capital city of New York, a Conference of much smaller proportions than this, but called together to consider the same questions; and at that time we were told that it was the purpose of Governor Tener to call this larger Conference, and we have been looking forward to this time as an epoch-making event.

It has been suggested that we should do nothing to counteract the ravages of the chestnut tree disease, because we are not fully informed as to how to proceed. That is un-American. It is not the spirit of the Keystone State, nor the Empire State, nor the New England States, nor the many other great States that are represented here, to sit down and do nothing, when catastrophies are upon us. It has been suggested that we should wait patiently until the scientists have succeeded in working out these questions in all their minutiae; that thus we may be able to accomplish our results more quickly. But that is not the way that great questions are solved. If we had waited until the application of steam should be thoroughly understood, we would be still waiting for our great trains and steamboats, which are the marvel of the age. (Applause).

We know some things about this curse, and we are here to exchange ideas; to tell, on the one hand, what we have learned through our scientific studies, and, on the other hand, what we have learned through our practical work; and thus we believe that at the close of this Conference, we will all go away from here, wiser and better prepared to carry forward the great work in which we are interested.

Now we are here for business. The Governor has given us the keynote for the meeting. I should not take your time further in making remarks, but let me say to you that, so far as in me lies, these meetings will be expedited; they will begin on time; the programme will go forward without unnecessary delays; and I only ask that the Chair may have the sympathy and the cordial co-operation of the many delegates who are attending the meetings, to the end that when we close, we may all feel that it was well that we came together. Unless other arrangements are made, the Chair will understand the usual rules of procedure will govern our deliberations, and he will follow those rules to the best of his ability, being always willing to be corrected or to be overruled by those who are participating in the Conference.

The Chair will now recognize Mr. Samuel T. Bodine, of the Chestnut Tree Blight Commission.

MR. BODINE: In order that the deliberations of this Conference may be properly summed up, Mr. Chairman, I move that a Committee on Resolutions be appointed by the Chairman

of this Conference, of which he shall be a member ex-officio, which Committee shall be representative of the various States interested in the wild chestnut, and represented at this Conference.

The motion was seconded.

MR. S. M. ENTERLINE, of Pottsville, Pa: I would further add, Mr. Chairman, that these proceedings should be reported and printed, if that be possible, and forwarded to the delegates, as far as the supply of reports may reach.

THE CHAIRMAN: That question may come up properly a little later. The motion now before you is on the appointment of a Committee on Resolutions.

The motion was put and unanimously carried.

THE CHAIRMAN: The Chair will be pleased to receive, if the opportunity offers, suggestions from members as to their desires in this or any other matter.

The programme now calls for brief responses to the Governor's address, and it has been suggested that the best manner of procedure will be to call the roll of States which are represented here, asking one person from each State to make a response; and, in order that we may get through the list promptly, unless directed otherwise, the Chair will have to ask each State to limit its response to three minutes. It may be that some of the first names on the list are not prepared to respond at once. In that case we will pass them over and return to the names a little later.

Alabama. (No response).

Connecticut.

DR. GEORGE P. CLINTON, New Haven, Conn., Expt. Station: Mr. Chairman: I hold a commission from the Governor of Connecticut to represent that State, with two other delegates, at this Convention. In Connecticut we have studied this disease somewhat longer than you have here in Pennsylvania, and we have it in a very serious manner. I am not officially on the programme, but I have prepared some of my ideas and views on this subject which I wish, at the proper time, to present to this Convention. I have also a paper by Professor Farlow, from Harvard University, who has studied the history of this fungus, that I wish at the proper time to present to the Convention for their

consideration. I take it that we want in this Convention, to know everything that is known concerning the chestnut blight and from that to deduce our conclusions. In that respect I am prepared to present all that I know and my views on the subject, in order that the truth, if such is known at present, may come out.

THE CHAIRMAN: The District of Columbia. This includes the Federal Department of Agriculture. Is Professor Collins in the room?

PROFESSOR J. FRANKLIN COLLINS, Department of Agriculture, Washington, D. C.: I am not prepared to make any remarks for the District of Columbia. I come from another direction. I have no remarks to make particularly.

THE CHAIRMAN: We will give you an opportunity later, Professor Collins.

The Dominion of Canada. (No response).

Delaware.

Dr. WESLEY WEBB: Mr. Chairman, Delaware sends a delegate up here to learn the situation. Delaware itself is pretty thoroughly infested with this disease. Every chestnut growth and every forest has diseased trees in it. The only way to destroy the disease in Delaware, in my opinion, is to destroy every chestnut tree and clean it up. I doubt if any measures short of that would be successful; but still, something may be learned here that will modify that opinion.

THE CHAIRMAN: Georgia. (No response).

Illinois. (No response).

Indiana. (No response).

Maryland.

MR. J. B. S. NORTON: Mr. Chairman, I had supposed that Professor Patterson would speak for our State, as he is interested from the forestry standpoint, and I am interested in the Experiment Station from the nursery standpoint. We will have a problem to meet in our State in controlling this disease, and I am sure we are very actively interested in this work, because we are in the same condition as a few other States. We have a large part of our area already infested, and a considerable part

of it that is free, so it makes it a more active and important question to us than to sections where the territory is entirely covered with the disease.

THE CHAIRMAN: Massachusetts.

PROFESSOR F. W. RANE, State Forester: Mr. Chairman, I was sent out here by Governor Foss. I had an opportunity to have a conference with the Governor shortly before coming. We had hoped to bring along some of our large timber owners, but, at the last moment, it was impossible to make arrangements. The Governor said it would be impossible for him to be here, but urged me to extend his compliments to you by all means. In Massachusetts we are just beginning to realize that the chestnut bark disease is a very serious menace to us. During the past year we have had a man from the Department of Agriculture with us for three months, and I have had all my assistants in the State Forestry Department out in the field hunting it down. We find that it is scattered pretty much over the State. Our simple remedies we send out by men that are with us, and we are always ready to assist anybody in any part of the State with any suggestions possible in regard to it; but I do not care to talk about that at the present time. I am here to learn everything possible, and am glad to be here, I assure you.

THE CHAIRMAN: New Jersey.

DR. MELVILLE T. COOK: Mr. Chairman, in the State of New Jersey I find, although I have been there but a short time, that those who have looked into the situation most carefully are inclined to believe that, so far as the State is concerned, the situation is practically hopeless. Almost every chestnut growth in the State is infected at the present time. We expect, of course, to do some work in combating the chestnut blight, because we will not give up until the chestnut timber is entirely destroyed. While the majority of those who have been making a study of the conditions over the State look upon the situation as hopeless, yet we can say that there has some good come out of evil, because at the present time the people are wike-awake to the importance of the careful study of plant diseases. At the present time there is no difficulty, whatever, in getting the people to listen to any

advice that looks toward the protection of the natural interests of the State. So the State of New Jersey greets the Convention here to-day with honest hopes that something may be accomplished which will advance the public interest and welfare.

THE CHAIRMAN: New York.

GEORGE G. ATWOOD: Mr. Chairman, the State of New York appreciated very highly the honor extended by the invitation of the Governor to be here to-day, so as many as possible of the delegation accepted with pleasure. We are here to-day to learn something in order to perfect a plan that has been brewing in New York State. New York State has a large chestnut area to save. We have a small section of the State where the chestnuts are practically gone. Arrangements are being perfected for carrying on the work under the advice of the botanists of our stations, and we hope soon to have a forest plant pathologist, working either with the Department of Agriculture or with the Conservation Commission. The Governor of the State is very much interested in this proposition. We are waiting for some definite plan, which will be taken hold of as quickly as it can be devised, and as thoroughly as the necessities of the case require.

THE CHAIRMAN: North Carolina. (No response). Ohio.

DR. AUGUSTINE D. SELBY: Mr. Chairman, Ohio is very much interested in this Conference, because Ohio lies in the western part of the Appalachian chestnut belt, and, as State Pathologist, the problems of the chestnut bark disease would become our laboratory and field problems. As yet we are not aware that the disease exists in Ohio, although it may be so; but we are perfectly aware that our success is indissolubly bound up with the success of Pennsylvania and the states to the east of it. If Pennsylvania, either by reason of a natural change in conditions by which the parasite of this chestnut bark disease becomes less virulent, or by the trees becoming more resistant, is not able to save a portion of its chestnut growth, then Ohio will not be. If, on the other hand, Pennsylvania and West Virginia, as well as New York, are able to save their trees from the wrecking of this disease, then Ohio will realize the advantages of such a Confer-

ence and such work. I assure you that whatever efforts are made by this Conference, or whatever conclusions are reached by this Conference and whatever efforts are made by other States, these will be supplemented with vigor in our own area. Personally, of course, we are without experience in the disease. For ourselves, we feel that we have in the chestnut bark disease one of those occasional and epoch-making parasites which has arisen from the unknown and wrought incredible damages; that it will continue its aggressiveness through a long period may or may not prove to be true. If it prove to be true, then our difficulties are very, very great. If the conditions prove more favorable, our forests may be preserved.

THE CHAIRMAN: Rhode Island.

JESSE B. MOWRY, State Forester: Mr. Chairman, in behalf of the State of Rhode Island and the other delegates representing that State, I desire to acknowledge the very cordial welcome extended to us by the Governor of Pennsylvania. Last summer a systematic inspection of the State of Rhode Island was made, under direction of Professor Collins, and this disease was found to exist in the chestnut-growing portions of the State. We are very glad to be here, to learn what we can about it, and to profit by the pioneer work which the State of Pennsylvania is doing in behalf not only of its own Commonwealth, but in the interest of all the other States which grow the wild chestnut tree.

THE CHAIRMAN: Tennessee. (No response).
Vermont. (No response).
Virginia.

MR. GEORGE B. KEEZELL: Mr. Chairman, on behalf of the General Assembly of Virginia, I desire to return thanks to the Executive of this great Commonwealth for the invitation to be present on this occasion, and to take part in these deliberations. So far as Virginia is concerned, we are at this time perhaps fortunate in the fact that, if we have this dread disease with us, we have so far had very little complaint of it. We are not here to give any experience of our own which may be helpful to others, but to learn from others what may be of benefit to the whole

Commonwealth of Virginia. As was suggested by the Governor in his remarks, a great deal of the wealth of the Commonwealth of Virginia is in our chestnut timber interests. Within the last decade her chestnut timber has been the source of a great deal of income to Virginia, and of a great deal of wealth. Its more recent use, for tannic acid, has brought into great value the waste places of the State, and timber heretofore regarded as not very valuable has become one of the most valuable assets of the Commonwealth. Naturally, we are very much interested in anything that goes toward the preservation of this valuable timber, and at this time we are especially grateful for the invitation to be here, because our General Assembly is now in session, and bills have already been introduced looking toward appropriations to combat this disease; and we are particularly anxious to get all the information we can here, in order that we may go back and give our legislators the necessary facts. I have no doubt provisions will be made by the Commonwealth to fight the ravages of this disease.

THE CHAIRMAN: West Virginia.

DR. N. J. GIDDINGS: Mr. Chairman and Ladies and Gentlemen: I can assure you that the people who are most interested in West Virginia appreciate the opportunity which this Commonwealth has offered for meeting here and considering matters in regard to the chestnut bark disease. The chestnut in West Virginia is a very important tree. Just recently I learned of shipments from one station amounting to one hundred and fifty-five thousand pounds of chestnuts,—the wild nuts,— during last fall, and there may be other shipments that run as high, or higher.

The annual cut of chestnut in West Virginia for the last two years has been about one hundred and eighteen million feet, and has neither increased or decreased; but the disease is present in the State. To what extent, we do not know. We are in hopes to have at least one or two men in the field this spring to learn more in regard to the conditions in the State, and we hope to be in a position, after getting the details which we may from this Conference, to go back and undertake the work in a much better manner than we otherwise could.

THE CHAIRMAN: For the Dominion of Canada, the Chair will call on Dr. H. T. Gussow, of Ottawa, the Dominion Botanist.

DR. GUSSOW: Mr. Chairman: On behalf of the Department of Agriculture of the Dominion of Canada, I am here to thank you for your very great courtesy in asking us to participate in this very important meeting. I may say that, as far as we are concerned in Canada, we have not this dreaded disease at the present time, and we have been very anxious to avoid the importation of it across the border, by passing stringent legislative measures prohibiting the importation of chestnuts of any kind, nursery stock or even chestnut wood, or anything else connected with chestnuts. I find that this will probably be the only means to restrict the disease to the States in which it is found at the present moment, and I can only extend to you, neighbors of the United States, my best wishes to succeed in combating, or at least, restricting this very serious disease.

THE CHAIRMAN: Are there other States represented who have been passed over? Are there any States we have not heard from?

MR. J. W. FISHER, of Tennessee: Mr. Chairman, we are very greatly interested in this subject, because we have such a marvelous growth of chestnut in Tennessee. It is receiving very considerable attention at the present time from the axemen, for lumber and tannic acid. It has a vital connection with our water sources, because it covers the area so completely that if it were destroyed, it would vitally affect vast water powers and irrigation. We are therefore, extremely interested that you, in your deliberations, should find some means of checking this disease, that we may have our forests preserved to us. I shall take a great deal of pleasure in reporting whatever I can to our Governor, Hon. Benjamin Hooper, whom I have known for years and who comes from our town, so I think I am in an attitude to bring the attention of the State to this matter, and I shall be extremely glad to do so.

THE CHAIRMAN: Are there still other States represented, who have not been heard from? A number of delegates are expected in later in the day. You will all agree with the Chair

when he suggests that it is very much like having the play of Hamlet with Hamlet left out, when we fail to hear from the great State of Pennsylvania; but, as usual, this State asserts her modesty, and has insisted on being excused for the present. The Chair will assure you that later we will hear from the State of Pennsylvania, and from more than one person.

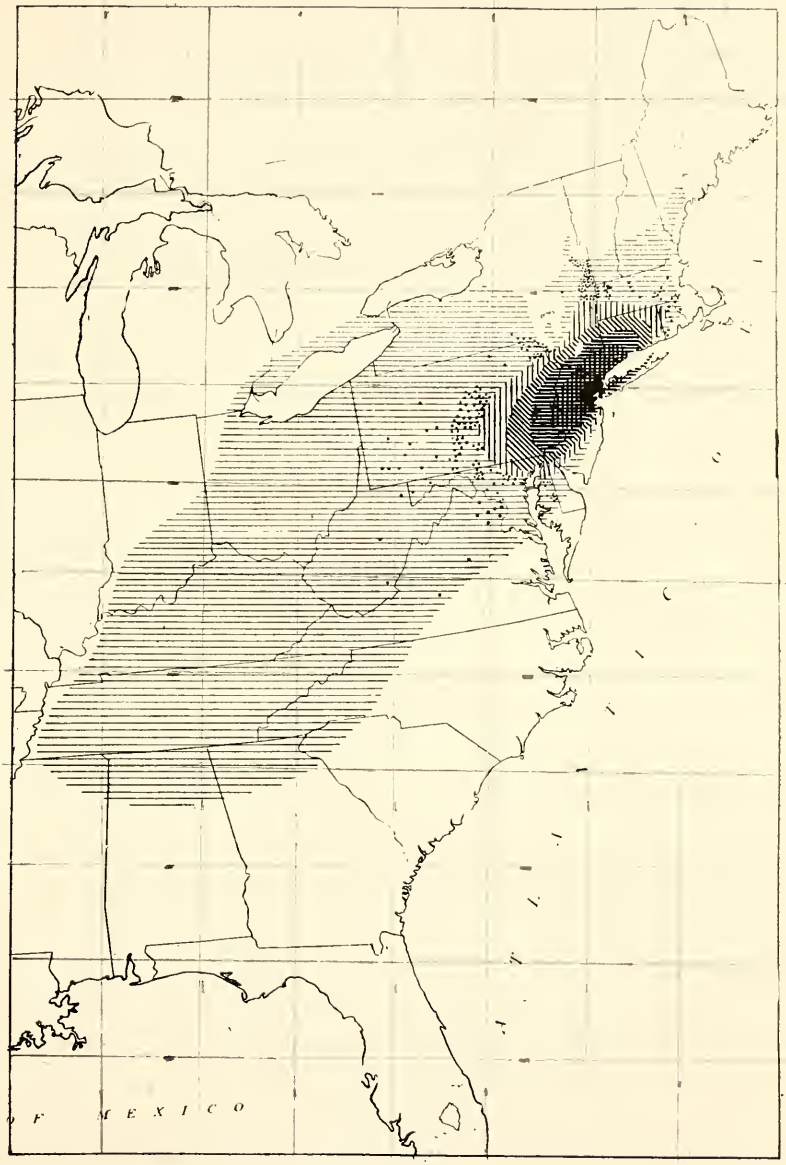
Unless it is otherwise decided by motion and vote, the Chair will request that all resolutions be handed in at the desk, without taking the time of the Conference to read them, to be referred directly to the Committee on Resolutions. This, however, may be overruled if the delegates desire to take the matter into their own hands.

I am informed that provision has been made for registration at one of the ante-rooms outside of the entrance to this chamber, and each one is earnestly requested to register his name, home address, official position, and his temporary Harrisburg address.

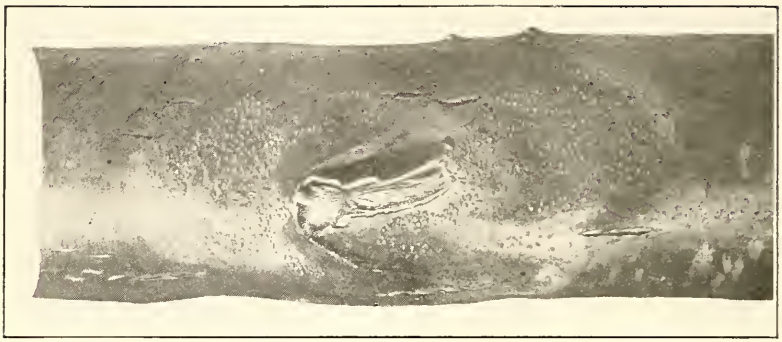
The program now calls for an address upon the "Historical Review and the Pathological Aspects of the Chestnut Bark Disease," by Dr. Haven Metcalf, of the United States Department of Agriculture. It is with the greatest regret that we have learned of the serious illness of Dr. Metcalf, which makes it impossible for him to be present at this time. Fortunately, however, we have with us Professor J. Franklin Collins, the Assistant Pathologist in the Federal Department of Agriculture, and Professor Collins has kindly consented to address us at this time.

ADDRESS OF PROFESSOR J. FRANKLIN COLLINS, OF THE DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

Mr. Chairman, Ladies and Gentlemen: It is with very great regret, for many reasons, as you can imagine, that I have to take Dr. Metcalf's place here. I came here rather unprepared to take his place. The accident to Dr. Metcalf occurred on Saturday night, and I had the chance to see him only a little while on



No. 35. Distribution of the chestnut bark disease. Horizontal lines indicate approximate distribution of uninfected chestnut; dots indicate isolated infected spots; the heavier lines in various directions indicate varying degrees of infection culminating in an area about New York City in which all chestnut trees are dead.



No. 1. Branch of a chestnut tree showing a disease lesion on smooth bark.

No. 2. Portion of a branch of chestnut tree, exhibiting a lesion started around dead stub, the pustules being especially prominent.

No. 4. Surface section of chestnut bark, with pustules in the crevices. Lower illustration shows pustule greatly enlarged, from which three spore threads have been produced.

Sunday. I have come here without many of his ideas. However, he has some slides which are to be shown, and perhaps I can tell you something about those, and so add to their interest.

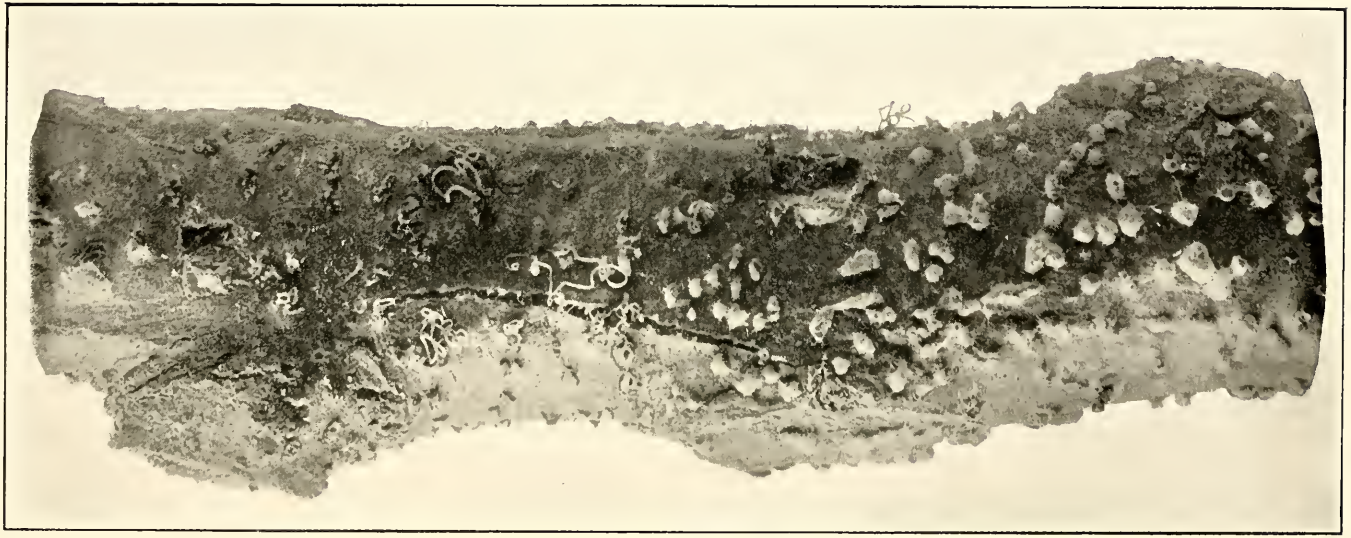
Before the slides are shown, I want, very briefly, to give a short sketch of the history of this disease. It will be very brief, and of a general nature only. The history of the disease has already been published in quite a number of cases, so I will touch only upon the main points.

Our attention was first called to this disease, I believe, in the fall of 1904 by Dr. Merkel, of the Bronx Zoological Park, in New York city. He noticed that chestnut trees were dying in greater numbers than seemed to be warranted by any previous knowledge of the dying of chestnuts. He looked the matter carefully over, as I understand it, and decided that there was a definite disease there, and later turned the material over to Dr. Murrill, of the New York Botanical Gardens. Dr. Murrill studied this disease and later published his findings upon it, naming the fungus which caused the trouble, *Diaporthe parasitica,* a new species of the genus. At that time, I believe, Dr. Murrill stated that it was a very serious disease, and sent out a warning to that effect. If I am misquoting him, I hope he will correct me, for he is in this room to-day. It was not until 1907, three years after the discovery of this disease, that a laboratory was established in Washington for the study of tree diseases. Since that time—almost immediately and since then—certain investigations, both in the laboratory and in the field, have been carried on in Washington. I do not propose to say anything about these studies at the present time. My point here is to give you a general idea of the disease, what it looks like, how it affects a tree, and things of that sort,—a general discussion of the topic. This review will be, will necessarily have to be, primarily an explanation of the views which will be thrown on the screen. I may elaborate at points, but, as I say, I am not primed as Dr. Metcalf would have been had he been able to be here. I think perhaps we may as well proceed to the views at once.

Slide No. 1. This, to begin with, shows a diseased spot, as we will find it on the smooth bark of a branch of a chestnut tree, a branch which is perhaps anywhere from three to six inches in diameter. The disease is a fungous disease, and starts its

growth from a very miscroscopic, one-celled body, which we know as a spore. By some means the spore reaches a place in the bark of the chestnut, where conditions are favorable for its growth. Its growth is not essentially different from that of the spores of other fungi. It consists mainly, or principally, of a threadlike growth coming from the spore. This threadlike growth branches, and finally we have a great mass of threadlike filaments. In the case of the chestnut disease, the spore may gain entrance at some point, say here, or some little break here, possibly (indicating on slide), and perhaps occasionally without any break at all in the bark. The growth in the bark continues to increase in size, that is, the general area of the growth, and sooner or later, the same as in practically all plants, we have a fruiting stage of this fungus. This view shows some of these fruiting stages, as we ordinarily see them on the chestnut. Some of the stages, which are not quite so common, will be shown a little later; but I want to call your attention to the fact that, from this point to the point away over there (indicating) we have an area of disease. As a rule the bark in the smooth-barked limbs is somewhat sunken, where the limbs are two or more inches in diameter. Where they are below that diameter, the diseased area may be an enlargement rather than a depression in the bark. These little yellowish spots which you see all over here, many of them, are smaller than the head of a pin. They are of various colors, but usually some tint of yellowish brown or orange, or sometimes they weather to a darker color. Those pustules are what we know as the fruiting pustules of this fungus. These pustules, during the growing season, in the summer as a rule, produce a certain type of spore, and later in the season, or at a later stage in the age of the disease, at least another type of spore. For convenience we will speak of the first type as the summer spores and those of the later stage as the winter spores.

No. 2. This shows a similar branch with a lesion, which has started evidently from around this old dead stub, and this has spread until we get the diseased area from this point, from here probably, (indicating) up to the top of the picture. Now during the summer, or rather after a rainy spell which is followed by a dry spell, perhaps two days or one day or three days after the rain has ceased, we shall find that these pustules, or fruiting



No. 5. Pustules on the bark; some showing spore-threads; (magnified).

spots, have pushed out a little mass, a threadlike mass, in much the same way as you would press out the paste from a collapsible tube by pinching the tube. As a result we get, perhaps, from one of these pustules, anywhere from one to fifteen or twenty structures of that sort, (indicating) which are, of course, here greatly magnified. This represents the pustule at the base, this yellow area; and this is one of the threadlike masses which has been forced out by the swelling of the mucilaginous matter in the pustule.

No. 3. Each one of those masses shown at the right hand side of the view is composed of many hundreds of thousands of spores, no larger than bacteria. One of these spores may, so far as we know, under favorable conditions, reproduce this fungus and consequently reproduce the disease, if it starts growth in the proper place.

No. 4. This shows simply a somewhat larger view of one of those pustules, from which three of those spore threads have been produced. At the upper part of this picture we have a surface view of the chestnut bark in which we find the pustules gathered in the crevices. This is rather characteristic on chestnut bark that is of a sufficient age to be cracked. Only on smooth chestnut bark, as a rule, do we find these pustules all over the bark. In the cracked bark we find them primarily, if not entirely, in the crevices.

No. 5. There we have a section of a small branch that shows some of these pustules, and above some of these threads as they appear on the bark of the chestnut. I have nothing special to say about that view, except that, so far as the color is concerned, we are apt to get it just that color, but quite as often somewhat darker, with a little orange or reddish tint to the pustule.

No. 6. Now if we take one of those areas of disease on smooth bark and cut into it, if we shave the top of the bark off with a sharp knife,—suppose we take just such a case as we have at the left here (in fact this is made from the same branch) and shave it so as to show what is beneath,—we get a discolored area, a rather characteristic area, which is not shown as well in this view as it will be in another; but remember that this view at the right represents such a branch as that at the left, with the surface of the bark removed with the knife.

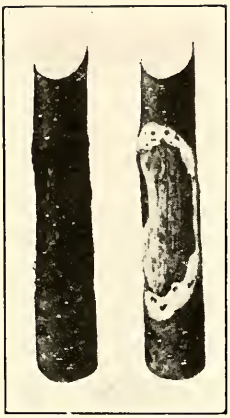
No. 7. Here is a view which represents a branch, from which the surface of the bark has been shaved in the same manner as in the last view, but here we have the characteristic fanlike mottling, which we often get in the bark beneath the surface. Some times the effect which you see here is produced immediately beneath the surface of the bark, at other times down in the middle of the bark, and at other times you have to get in pretty well towards the wood in order to find this characteristic marking, depending largely upon whether there is a perfect epidermis, or perfect skin, over the bark, or whether there is a corky layer; but it is not entirely gauged by those characters. This line (indicating) representing the line of discoloration; the infection started at this point and radiated in all directions from the common starting point. Of course, if we shaved off the other side of that branch, we should have expected to find about the same condition of affairs there; but here we have shown only the half circle of the more or less circular area of the disease.

No. 8. Here are two branches of a chestnut tree, an orchard tree as I recall it. These branches are about four or five inches in diameter. This represents a very common appearance on chestnut in the smooth-bark stage. Of course, this has begun to crack more or less from age. That is not an exceptional case by any means, as all who have seen the disease will readily realize.

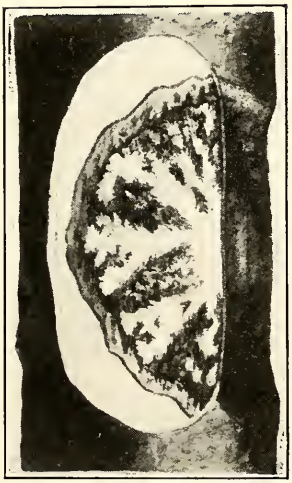
No. 9. This represents another case of a diseased portion, in which the disease started about at this point (indicating). One of these cracks probably represents the position of the starting point of the disease, and it has radiated in all directions, tending to form the circular mass which is shown here, running down there and across the bottom and of course off of the view entirely at the right. That is a grafted tree, by the way, and the enlarged portion at the middle of the tree represents the graft line.

No. 10. This is merely a section of a little older piece of bark, where we get the pustules of a darker color, that is, more of the brownish tinge, as we often do in weathered bark. This, as I said a moment ago, is found in material which has withstood the weather for some time.

No. 11. This is another view which shows merely some of the older pustules. This is intended more to represent the winter stage of the fungus. I do not think, however, that you will be



No. 6. Sections of smooth-barked chestnut twigs showing disease lesions. Surface of bark removed from right-hand specimen, showing discolored and diseased areas.



No. 7. Characteristic fan-like mottling revealed by shaving the bark of a diseased branch.

No. 8. A large area of disease pustules on a smooth-barked orchard tree.—*Photograph by Prof. Collins.*

No. 9. Bark removed from over a canker, showing the cracks at the centre and the fan-shaped spread of the yellowish fungous mycelium; also, at the lower edge, the circular margin of the disease.—*Photograph by Prof. Collins.*

able to make out the individual little spots which go to make up one of these common masses. The winter stage of this disease produces its spores down in the bark; that is, down beneath the surface of the bark, and so also does the summer spore stage, except that in the summer spore stage they are extruded in the form of these threads, while the winter spores are not extruded in the same way, although they are extruded later.

No. 12. This view represents a diseased spot on an orchard tree. The diseased spot is less than three years old, but more than two years old, according to the records which were kept. This shows, at the upper part of the picture, how the bark soon loosens and later falls from the tree and the branches, until finally we have simply the bare trunk or a bare branch left. Sometimes this bark breaks away in less than two years, to much the extent that is shown there.

No. 13. Here is a small twig of a chestnut. A little while ago I mentioned the fact that, in the smaller twigs, we sometimes had an enlargement when the disease was present, rather than a depression. Here at the left we get the normal size of the twig, and then, running out this way towards the apex of the branch, we see where the disease started, and we have this considerable swelling. This is quite characteristic, under certain conditions, of twigs which are less than a half inch in diameter. It sometimes occurs in larger branches, but as a rule we get it quite commonly in this type of branch.

No. 14. In the older trees, where the bark has become deeply furrowed, I said that we found the diseased pustules almost entirely in the cracks or crevices of the bark. This represents the surface,—greatly magnified, of course, and beyond what you might imagine,—and some of the furrows. We get the yellowish-orange pustules in the crevices there, and in various places, whereas the other parts, the raised places, show no pustules at all.

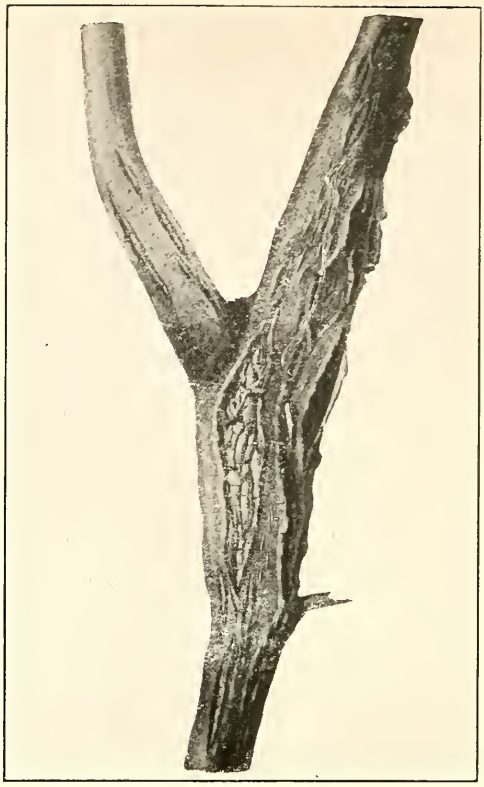
No. 15. So much for the disease as it appears on the branches. Now when the disease appears on a branch, or on the trunk of a tree, it starts from the common point and radiates in all directions, forming the more or less circular area of disease. Of course, on the trunk of a tree it goes up the trunk from the com-

mon point, down the trunk, and around the trunk. When these portions of the disease which go around the trunk meet on the other side, we have a branch or a trunk which we speak of as girdled. Now a girdled branch, or a girdled twig, or a girdled trunk, means the early death of all parts of the tree beyond the girdled area. If it is a twig, it means the death of the twig beyond the girdled area. If it is the trunk, it means the death of the whole tree at once, or soon after the girdling is completed; not immediately, as a rule. Now I want to call your attention to some of the obvious effects of this girdling upon the foliage of the tree. When you are looking for this disease during the season of foliage, it can be detected oftentimes at a great distance. I have myself detected diseased trees more than a mile away, or trees supposed to be diseased, by the characteristics which I want to call your attention to now. To be sure, you must bear in mind that the coloration of the leaves to which I am going to call your attention can at times be brought about by other things than this disease; but we have in the coloration of the leaves, as we generally say, the "danger signal" which suggests where to look for the disease; for, if the disease has been going on very long, for a few months, or weeks even, in certain places, we shall get some of these discolored leaves as the result of the girdling of some one or more of the twigs or branches. I have shown here a somewhat normal chestnut leaf. It is a little broader than the normal leaf; this is intended to represent not, perhaps, a perfectly typical chestnut leaf, because we have on the margin a little paler green than in the portion in the centre. The pale green in the margin of every leaf at times, is one of the first symptoms of discoloration. It becomes a little pale. First of all, perhaps, the leaf wilts a little, if you notice it carefully, and if this paleness of the leaves is extended over the leaves of a whole branch, the effect as a whole is quite noticeable.

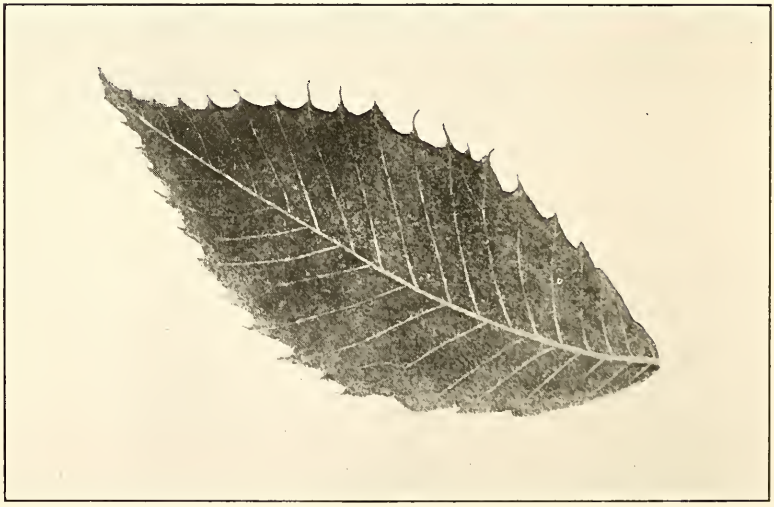
No. 16. Here is a greenhouse plant which has been inoculated with the disease. At the left we find some of the normal chestnut leaves; at the right a branch which had been inoculated and has been girdled way down here. (Indicating). Now I do not know about that particular specimen, but, if we were looking for the disease on such a specimen as that, we should never look up here for it, that is, not primarily. What is causing the trouble

No. 10. Bark showing pustules of a dark color or of a brownish tint, due to longer exposure to weather.—*Photograph by Prof. Collins.*

No. 12. Diseased chestnut tree showing shredded bark after two or three years infection.—*Photograph by Prof. Collins.*



No. 13. Small twig of chestnut with enlargement due to disease. At the left side the normal size of the twig is shown.



No. 15. Normal chestnut leaf. A pale green in the margin is one of the first symptoms of discoloration and disease.

with that stem is down here somewhere, down below all these dead leaves. That applies to looking for the disease on the tree, or on the sprouts or suckers which may come up from the base of a tree.

No. 17. In very young nursery stock, or the young sprouts which come up from a tree, or the vigorous growth on a tree, on the twigs at least, we often get this type of the disease at its very beginning. This is often more brilliantly colored than shown in this view. It is very conspicuous indeed, particularly on nursery stock. Although the view does not show any fruiting pustules at all, by cutting into that area we get the characteristic mottled mycelium or vegetative stage of the fungus beneath the bark.

No. 18. Now we have a branch which shows the withered and yellowish leaves. This yellow color follows along after the pale green color. It is not a pure yellow, as a rule, although sometimes it has been quite strikingly of a pure yellow color. You will notice that the leaves wither after awhile; that is, they crumple up after a time and that crumpling is shown, to a certain extent, in this view; and also the yellow color.

No. 19. A little later we have the deeper color. This shows the browner coloration around the margin of the leaves. At the left we have two leaves which show merely the beginning of the discoloration. At the right the leaf is somewhat crumpled, bent, and discolored.

No. 20. This is a stage much the same as that of the little branch which was shown three views back, this showing a larger view of the same thing.

No. 21. Finally the leaf assumes a somewhat brownish tint, which is shown here. The leaves in this condition are often more crumpled and curled up than shown here. These two leaves have been flattened out somewhat so as to show the color.

No. 22. Now to take some of the woodland views, to show how the disease looks in the landscape. Here is a large tree which, owing to lack of special instruction as to the coloring of it, lacks one or two features which it ought to have. For instance, this branch up here, and that whole branch (indicating), ought to have shown the yellow brown color. The coloring, however, was not noticed in time to give instructions in regard to it. This view, however, is shown primarily to represent the type of tree

which is so valuable in the large estates in the various States. This particular tree had a circumference, above the settee which is there, of more than nineteen feet. The view was taken three years ago. That tree now has only two or three of the green branches left and the whole top of the tree is cut off. I am sorry I do not have the other views to go with this, but through some slip somewhere they were not forwarded to be shown.

No. 23. Now we have a view in which the disease has a start up in this corner, and the discoloration of the leaves, or the masses of leaves, is here shown. Now a discoloration of this sort, particularly when it comes to a little later stage and has a more brilliant color, is quite conspicuous in the landscape. This view does not do credit by any means to the point which is intended to be brought out here.

No. 24. Here is a view taken on Long Island, which shows the effect on the tree; a tree which has been nearly killed by the disease, showing the practically defoliated type of tree. Here is another type, (indicating), which has become badly diseased, and we have a bunch of sprouts appearing at this point, also here, and also basal sprouts coming up. These sprouts are rather characteristic; perhaps I should not say characteristic, but they are commonly found connected with this disease, and are supposed to be more or less characteristic of the disease, but the sprouts can be produced by other means than as a result of the disease.

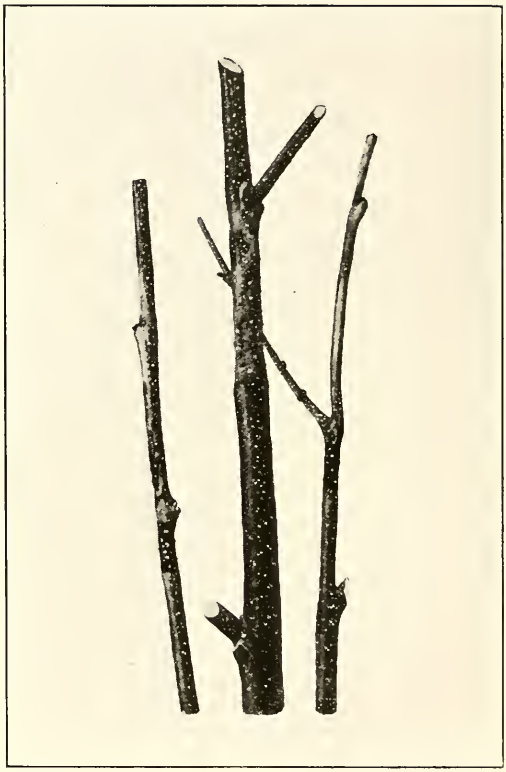
No. 25. Another tree, also on Long Island, in which all but two of the lower limbs on the left hand side have been killed by girdling from the disease, and now we have remaining only those two, or perhaps three, lower left hand limbs.

No. 26. This is a tree showing the sprout growth which I alluded to in one of the last pictures, to even better advantage. Notice the sprouts which come up around the base, and the sprouts which come from the trunk at various places up in the crown.

No. 27. There you have another type of the same thing, a more pronounced example, in which the sprouts are confined almost entirely to the trunk of the tree and everything is dead or dying, except perhaps one or two branches.

No. 28. This view is shown in order to call to your attention this particular tree (indicating), which shows four good lesions

No. 16. A green-house chestnut tree in pot, three months after artificial inoculation with summer spores. *Photograph by Brewer.*



No. 17. Early effect of the disease upon young chestnut sprouts and nursery stock.

No. 18. Characteristic withered and yellowish leaves on chestnut twig infected with the disease.

of the disease, diseased spots, on the trunk of the tree. That is the way the tree looks when this disease attacks the trunk. That tree is practically dead. The lower part, represented by the lower half of that picture, shows some life.

No. 29. In the course of two or three years we find that the bark begins to peel from the trunks of the trees. At the left we have a tree which has only recently been killed, that is, within a year or so perhaps, and the next one to it is one which is a little older, and the bark has begun to peel off. The one which is so prominent is probably the first in the group which was attacked and killed, and the bark has practically disappeared from the tree, so far as this view shows.

No. 30. Now to consider the more general appearance of the woodland, here is a view taken in Forest Park, Brooklyn, along the Boulevard. This is one of the main boulevards through the Park, and any of you will have no difficulty in picking out the chestnuts. They are the most conspicuous objects. Not one of the green trees you see there is a chestnut.

No. 31. Here is another view taken, I think, at Port Jefferson on Long Island. It may have been a New Jersey view; I am a little uncertain as to just where it was taken. That shows the young growth coming up and becoming diseased, and shows the effect along the hedgerow that we get from this disease.

No. 32. This is one of the most southern stations which we know for the disease. This view was taken in South-western Virginia, in Bedford county. The more prominent trees there have lost the bark entirely. Those trees, I understand, have been cut out and no longer exist.

No. 33. If you want to see what the chestnut disease can do in a very nearly pure stand of chestnuts, there is a view which will show it. That was taken in Forest Park on Long Island. Any of you who have been in Forest Park will probably recognize that view.

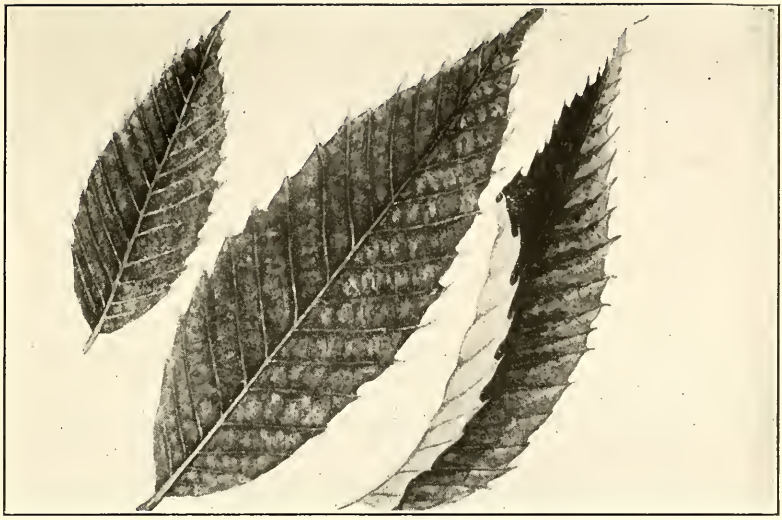
No. 34. The next view, I think, is another view of a little different portion of the same Park. These trees at the right are not chestnuts at all. This one up here, I believe, is a chestnut and there are some oaks there at the left.

No. 35. I want to call your attention to the distribution of the chestnut, and, to do so, I want to call your attention to this map.

This map represents the eastern portion of the United States and the horizontal lines represent the approximate general distribution of the chestnut tree. It may not be exact. I think most any of you who live at or near the border line represented here would have some suggestions to offer, but the map has been compiled from as reliable general sources as we could obtain. Thus we have the chestnut from northern Mississippi, through northern Alabama and Georgia, northwestern South Carolina, western North Carolina, up through this region and up into the northwestern edge of Androscoggin county in Maine. In New Hampshire and Vermont there are only a few chestnuts present, as compared with the region farther south. Down through here (pointing to the southern Alleghanies), we have our great chestnut stand, particularly on the western slope of the mountains. In the State of Connecticut a bulletin which was published within a few years stated that probably more than fifty per cent. of the forest trees in Connecticut were chestnuts. That was on very good authority, and I do not hesitate to quote it. In Rhode Island the chestnut is of a little less importance, but probably pretty nearly half of the trees in Rhode Island are chestnuts. The proportion further south I am not so well informed about, but we have the bulk of the heavy chestnut timber south of the Potomac River. The black area on the map represents the places where practically all the chestnuts are now dead, and the various forms of lines which are shown on the map represent varying degrees of infection, until we come down to the line right here. (Indicating). These vertical lines represent the approximate limits of what you might call somewhat general infection. The black spots which are shown there represent the outlying spots of infection, so far as we knew them in December. Here is the line through Pennsylvania. The eastern part of Pennsylvania is pretty well infected with the disease, and the work now being done in this region, (indicating), will be told about a little later by someone who is better informed than I am.

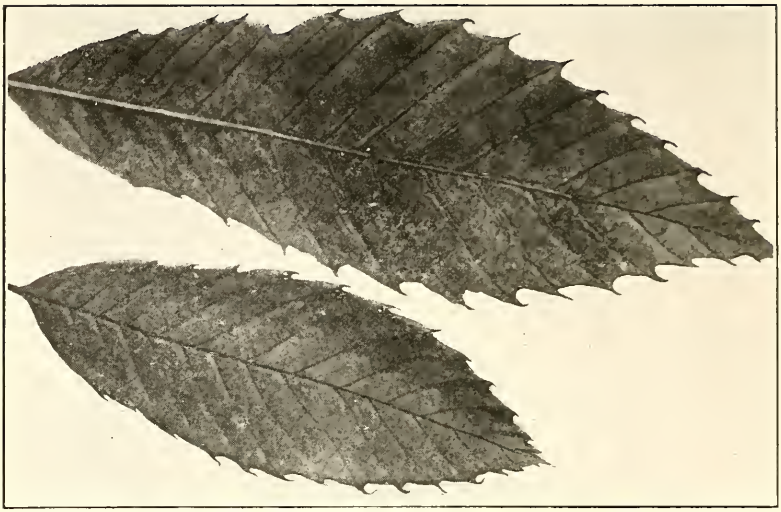
In closing this address, I want to read just a few words and, if we can have the lights now, I will finish in about two or three minutes.

Having seen what this disease is and what it is doing, we now come to the question which, I take it, we are gathered here to



No. 19. Leaves of the chestnut exhibiting discolorations and curling of leaves caused by the disease.

No. 20. Curled and discolored leaves of the chestnut at an advanced stage of the disease.



No. 21. Leaves of the chestnut, showing brownish tint from effect of girdling by the disease.

No. 22. Types of ornamental chestnut trees killed by thousands. Note the small, diseased branches. Scene near Philadelphia, Pa.—*Photograph by Prof. Collins.*

answer as best we can: What are we going to do about it? That is the question. Three conditions lie open before us, as we see it:

First: Do nothing; lie down and let the disease spread as far as it will, and destroy as much property as it can. It must be acknowledged that there is ample precedent for this course, as well as ample scientific support. Beyond question, this is the easiest thing to do.

Second: Conduct scientific investigations of the disease, but make no attempt to control the disease until these investigations yield conclusive results. Such a course would unquestionably yield results which would be valuable in future epidemics of disease, but it would not save the chestnut trees at this time. The President of the Carnegie Institution, in a recent address, enunciated the principle that the results of scientific research must be stated in decades, not in years. We must investigate the disease as thoroughly as possible, but investigation alone, without application, will not save the trees.

Third: Investigate as thoroughly as possible, devote as much money as possible to research on the fundamental problems relating to the disease, but, at the same time, put into force immediately whatever measures against the disease appear to be most promising, recognizing clearly that there is not time first to prove absolute efficiency. I am informed that, as an immediate result of the recent burning of the Equitable Building in New York city, a special commission was appointed to devise better methods of fighting fires in the congested business section of New York. The appointment of the commission was necessary and will unquestionably yield excellent future results; but I notice that the New York Fire Department, went ahead and did its best to put out the Equitable Building fire, without waiting for the reports of any commissions. It appears to me that we are in much the same situation. The fire is burning too fast for us to wait for the reports of experiments which will take from two to ten years time to carry out. We must go ahead, using the best methods that we have, and leave the results to the future. (Applause).

THE CHAIRMAN: I am sure everyone will agree that this talk has been both instructive and interesting, and we are particularly indebted to Professor Collins for stepping in at the eleventh hour, as he has done, and favoring us so generously.

PROFESSOR SELBY: Mr. Chairman, would it not be proper for us to send, on behalf of this Convention, at this time, an expression of our sympathy with Dr. Metcalf in his serious accident? I move you that such an expression be sent by the Convention.

Seconded by Mr. I. C. Williams.

THE CHAIRMAN: Such a motion naturally would go at once to the Resolutions Committee, but the Chair is glad to make an exception in this case. Professor Selby moves that this Conference send a message of sympathy to Dr. Metcalf, with hopes for his speedy recovery.

The motion was put and unanimously carried.

THE CHAIRMAN: The Chair will appoint Professor Selby a Committee of One to prepare and forward the message.

The next on the program is a paper entitled "Can the Chestnut Bark Disease be Controlled?" by Professor F. C. Stewart, of the New York Agricultural Experiment Station.

CAN THE CHESTNUT BARK DISEASE BE CONTROLLED?

By PROF. F. C. STEWART, *New York Agricultural Experiment Station.*

Mr. Chairman and Ladies and Gentlemen: My views are so much at variance with what I conceive to be the sentiment of this Conference that I hesitated somewhat to present them. I feel like one throwing water on a fire which his friends are diligently striving to kindle. But a sense of my duty to the public and, also, myself, impels me to proceed.

I assume that you are all familiar with the method of control which has been recommended, namely, the one which has been outlined by Dr. Metcalf and Prof. Collins in Farmers' Bulletin No. 467, so I shall not take time to explain it. If you are not familiar with it, you will become familiar with it before the close of this meeting.

No. 23. Very early stage; infection of twigs in top of trees, at upper right-hand side. Lancaster county, Penna.—*Photograph by Prof. Collins.*

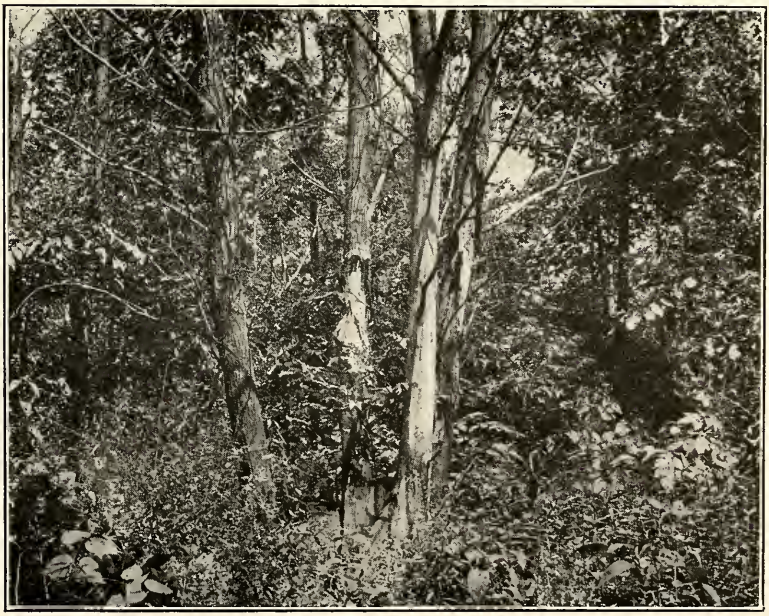
No. 24. Type of diseased chestnut tree on Long Island, New York, showing characteristic sprouts.—*Photograph by Prof. Collins.*

No. 25. Tree nearly dead from the disease. Only the two lower left-hand branches remain alive. Scene near Cold Spring, New York.—*Photograph by Prof. Collins.*

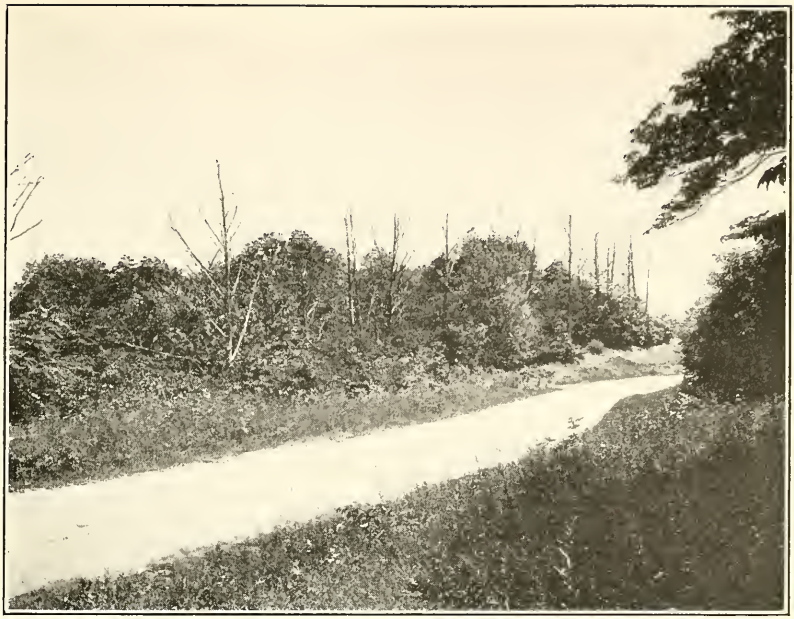
No. 26. Chestnut trees on Long Island, New York, showing the effect of the girdling of the tree by the chestnut bark disease.—*Photograph by Prof. Collins.*

No. 27. A chestnut tree on Long Island, New York, with sprouts at various points on the trunk.—*Photograph by Prof. Collins.*

No. 28. The chestnut tree in the centre of the picture shows four well-developed lesions.—*Photograph by Prof. Collins.*



No. 29. Typical group of dead chestnut trees. Note dead suckers on the trunks. From left to right:—the first trunk shows the disease less than one year old, (nothnig evident in this photograph); the second, an infection of from two to three years old; the third four or more years old; and the fourth about three years old. Scene near Brooklyn, New York.—*Photograph by Prof. Collins.*



No. 30. Dead chestnut trees along a boulevard near Richmond Hill, New York. Note healthy condition of trees of other species.—*Photograph by Prof. Collins.*

No. 31. Dead and dying sprout growth. Note healthy condition of trees of other species. Scene at Port Jefferson, New York. *Photograph by Prof. Collins.*

No. 32. The most southern point of infection—a group of diseased chestnut trees at Fontella, Bedford county, Virginia.—*Photograph by Prof. Collins.*

No. 33. Complete destruction of chestnut trees in a nearly pure stand. Many of the trunks have lost their bark. View in Forest Park, near Brooklyn, New York.—*Photograph by Prof. Collins.*

No. 34. Complete destruction of chestnut trees in a nearly pure stand. Many of the trunks have lost their bark. Scene in Forest Park, near Brooklyn, New York.—*Photograph by Prof. Collins.*

It is my opinion that we are rushing into this enormously expensive campaign against the chestnut bark disease without considering as carefully as we should the chances of success. The first question to consider is, can the disease be controlled by Metcalf's and Collins' method,[1] of destroying advance infections and establishing an "immune zone?" This is a technical question of fundamental importance. It is a question to be answered by expert mycologists and plant pathologists. I have observed that the leading advocates of the method avoid, as far as possible, discussion of its probable effectiveness. In Farmers' Bulletin 467, the question is disposed of by inserting into the letter of transmittal the following sentence: "The experimental data upon which the recommendations contained in this publication are based will be published in full in a forthcoming bulletin of the Bureau of Plant Industry." The authors then go on to say (page 10) that "so far as tested" the method is practicable; and on page 11, after giving an account of what they consider a successful attempt to control the disease in the vicinity of Washington, D. C., conclude with the following statement: "It is therefore believed that this method of attack will prove equally practicable in other localities and if carried out on a large scale will result ultimately in the control of the bark disease." Up to the present time the promised bulletin has not appeared and we are still in the dark as to the nature of the "experimental data." I had hoped that it might be presented at this meeting. In justice to the public it should have been published before Bulletin 467. There is great need of some real evidence that the disease can be controlled. Apparently, the sole foundation for the optimistic statements made by Metcalf and Collins in Bulletin 467 is the result of the field test[2] which they made at Washington and I hold that no definite conclusions can be drawn from that test. The chief criticism to be made of it is that there is no means of knowing what would have happened if the diseased trees had not been removed. There was no check, and experimenters are agreed that experiments without checks have little value. This is one of the first principles of experimentation. Weather conditions may have been unfavorable for the spread of the disease.

Most fungous diseases have periods of quiescence alternating with periods of activity, depending largely upon varying weather conditions.

Also, there is reason to believe that the region covered by the test is not now as free from the disease as Metcalf and Collins think it is. Last summer there were found two centres of infection previously overlooked.[3] One of these consisting of a group of six diseased trees, was within a few miles of Washington. In company with Dr. Metcalf and others I had an opportunity to examine these trees on December 30, 1911. One of them, a tree over three feet in diameter, was in an advanced stage of the disease. Large limbs were dead and the lower portion of the trunk was thickly covered with spore masses of the fungus. How long these trees had been affected it was impossible to determine, but it is safe to say that some of them had been diseased for at least a year and probably longer. That is to say, they became infected in 1910 or earlier and must have been discharging millions of spores at the very moment Dr. Metcalf was writing his statement that the country within a radius of 35 miles of Washington was apparently free from the disease.[4] It is quite probable that other overlooked cases of the disease exist in the vicinity of Washington at the present time.

Further, We visited two places where diseased trees had been removed and the disease "eliminated" in 1909. In one case, one tree had been cut; in the other case two trees. The bark had not been removed from the stumps. On one stump we found a few spore masses of the fungus; also on the base of a nearby tree. On the other two stumps no fungus was found. The first-mentioned stump had not sprouted, but the other two were surrounded by healthy sprouts. At both points there were a few chestnut trees in the immediate vicinity, but, so far as could be determined, none of them were diseased. It should be stated, however, that it is very difficult to locate diseased trees in winter. It is inevitable that the bark around the base of a diseased tree and also the surrounding soil, fallen leaves and other litter will become covered with spores carried down by rain. Hence, when the diseased trees were removed thousands of spores were left behind. How long such spores live and retain their power of infection is not known. Now does it seem probable that the

failure of the disease to spread to nearby trees was due to the removal of the diseased trees? Is it not more likely that its spread was prevented by the conditions being unfavorable for infection?

Returning now to the main question: No such method of controlling a fungous disease has ever been attempted. Our knowledge of fungous diseases in general indicates that it is impracticable. It will be extremely difficult to locate all of the diseased trees and absolutely impossible to remove all of the fungus after the diseased trees are found. The fungus spores, which are produced quickly and in enormous numbers may be widely disseminated in several different ways, some of which cannot be prevented. The work will be exceedingly expensive and must be continued indefinitely. Taking all these things into consideration, the chances of success are much too small to warrant the expense.

It is true that some fungous diseases, notably the plum black knot, are more or less successfully controlled by the prompt removal of diseased plants or parts of plants; but it should be noted that the diseases successfully controlled in this way have two characteristics which make this method of control possible: (1) The diseased plants may be readily detected in the early stages of the disease; (2) the causal fungus requires a long time to ripen its spores. Plum black knot may be readily detected from one to several months before the ripening of the spores of the causal fungus. Hence, the knots may be removed before they have had a chance to spread the infection. Not so with the chestnut disease. It possesses neither of these characteristics. It is difficult to detect in the early stages, and multitudes of spores may be produced within a month after infection.

Undoubtedly, the spores are carried long distances by birds, especially woodpeckers, which visit the diseased trees, seeking borers, in the tunnels of which most of the infections occur.[5] It naturally follows that the "Immune zone" must be many miles wide,—Dr. Metcalf suggests ten or twenty miles wide. In this connection, please note that while the main line of infection is now somewhere north of the Potomac river, advance infections already occur in southern Virginia and West Virginia, 150 miles or more southwest of Washington. In fact, Metcalf and Collins

say:[6] "Observations made by the junior writer indicate that the disease may have been present in an orchard in Bedford county, Va., as early as 1903." The advance infections are widely scattered.

Back of the "immune zone" extensive areas must be inspected frequently and thoroughly. Should the "immune zone" be located at or north of the Potomac, the entire States of Virginia and West Virginia must be covered by such inspection. There is no knowing when or where the disease may break out, and when conditions for its spread are favorable, a single diseased tree overlooked may start an uncontrollable epidemic which will necessitate establishing a new "immune zone" farther south and starting all over.

It is quite generally admitted that it will be difficult to locate *all* of the diseased trees, but there is some difference of opinion as to the importance of this fact. It may be argued that by the destruction of 90 or 95 per cent. of the diseased trees the spread of the disease will be reduced to that extent. This is very improbable. If this disease behaves like fungous diseases in general, its spread depends more upon weather conditions and the susceptibility of the host than upon the number of spores produced. When the conditions for its spread are favorable five per cent. of the spores may be sufficient to nullify any attempt to control the disease. All experience with such methods of treatment goes to show that the work must be done thoroughly, else it is not effective.

The history of the chestnut bark disease is unparalleled in the annals of plant pathology. Here we have an unknown fungus, none of the relatives of which are parasites, suddenly becoming widespread and taking high rank as a destructive parasite. This indicates that it may be expected to behave in an erratic manner and be unusually difficult to control; also, that something unusual has happened either to the host or to the fungus, or perhaps to both, making this epidemic possible. Just what this may be I am unable to say. There is no reason for believing that the fungus is either a recent creation or a recent introduction from abroad. The only rational theory yet advanced regarding the origin of the epidemic is Dr. Clinton's winter-and-drought-injury theory,[7] but even this seems insufficient in some respects.

It has been asked "What then would you have us do? Stand idle while the disease destroys our chestnut forests" My answer is this: It may be well to restrict the transportation of diseased nursery stock, but this is all that it is worth while to attempt at present in the line of combating the disease. *It is better to attempt nothing than to waste a large amount of public money on a method of control which there is every reason to believe cannot succeed.* I believe in being honest with the public and admitting frankly that we know of no way to control this disease. I favor moderate-sized appropriations for investigation of the disease, but none at all to be used in attempts to control it by any method or methods at present known.

What will be the future course of the disease can only be conjectured, but it can be safely predicted that nothing which man can now do will materially alter its course. However, the situation is by no means hopeless. That the disease has already reached its zenith and will now gradually subside is quite possible. There have been other epidemics, and other kinds of trees and plants have been threatened with destruction through disease, but such a thing has never actually happened. So far as known, no plant has ever been exterminated by disease. It is unlikely that the chestnut will be exterminated.

THE CHAIRMAN: It occurs to the Chair that the situation would suggest discussion at this time, but it would probably be better to continue with our programme as it was ably laid out by those who have provided for this Conference, and have the discussion after we have heard the papers. We will, therefore, call for the next paper, entitled "How Further Research may Increase the Efficiency of the Control of the Chestnut Bark Disease," by Professor W. Howard Rankin, Cornell University, Ithaca, New York.

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1. Metcalf, H. and Collins, J. F. The control of the chestnut bark disease. U. S. D. A. Farmers' Bul. 467, 28 O. 1911.

2. Loc. cit. p. 11.

3. Reported by Dr. Metcalf at a conference on the chestnut bark disease held in Albany, N. Y., October 19, 1911.

4. U. S. D. A. Farmers' Bul. 467:11.

5. U. S. D. A. Farmers' Bul. 467:10.

6. Metcalf and Collins. The present status of the chestnut bark disease. U. S. D. A. Bur. Plant Indus. Bul. 141, Part V, p. 46. 30 S. 1909.

7. Clinton, G. P. Report of the Botanist, 1908. Conn. Exp. Sta. Rpt. of 1907-1908: 879-890. July, 1909.

HOW FURTHER RESEARCH MAY INCREASE THE EFFICIENCY OF THE CONTROL OF THE CHESTNUT BARK DISEASE.

BY PROFESSOR W. HOWARD RANKIN, *Cornell University, Ithaca, N. Y.*

Mr. Chairman, Ladies and Gentlemen: Up to this time investigations concerning the chestnut tree canker disease and the causal fungus have not brought forth facts as rapidly as we could wish. It was the opinion of the conference held at Albany, N. Y. last October that we did not have facts enough about the disease and that scientific research was the one thing needed. To emphasize this point we may consider some important phases of the disease which are yet little understood, but the knowledge of which is fundamental to devising efficient control methods. Concerning the means of spread of the fungus from one tree to another we have nothing except secondary evidence. Most writers have theorized on the different methods by which the conidia or summer spores might be carried from one tree to another and a new infection started. Reasoning by analogy with what is known of the behavior of many fungi, such agencies as borers, birds, ants and the wind, etc., have been suggested but in no wise proved to be responsible. It seems that the ascospore stage has not been considered by any writer in the dissemination of the fungus, yet this stage follows the conidia very quickly and is the more abundant fruiting stage which is formed in the red or brown pustules on the surface of the cankers. Under moist conditions the ascospores are shot forcibly out in the air where they can be caught up by the wind and carried for a considerable distance. The speaker found the ascospores being shot from mature pustules during every rainy period last summer. These spores germinate readily in rain water producing a new mycelium of considerable length in fifteen hours. The question at once arises, why could not these ascospores once shot into the air be carried long distances and owing to their abundance cause a large majority of the infection? The time of year at which new infec-

tions took place last summer in the Hudson River Valley was evidently about the time when the ascospore stage was just becoming abundant. It is an important matter then to determine the spore stage and the agency responsible for the spread of the fungus before we can hope to advise an efficient and effective control. For example, such precautionary measures as the peeling of logs before allowing them to be moved could be limited to the time of year when this was necessary and thus obviate a great cost.

Likewise the problem as to how the present epidemical characters exhibited by the disease have come about is as far from solution as it was six years ago. The speaker has recently collected and examined a fungus indistinguishable from the chestnut canker disease fungus on dead chestnut bark in several places in Virginia. No case of this fungus attacking living trees was found in the short preliminary examination made near Lynchburg, although several specimens were collected on dead bark of stumps from which trees were cut about two years ago. Also a fungus found in Pennsylvania on white, red and black oak has great similarity to the canker disease fungus. The possibility of having several strains of the same fungus identical as to microscopic characters, some saprophytic and others causing a virulent disease, is at once puzzling. One of two things has evidently happened, either the host plant has, under existing conditions, been altered in its physiological process enough to change its susceptibility to this heretofore saprophytic fungus, or the fungus has developed a parasitic habit independent of any change in the host. Possibly, of course, both factors may have combined to bring about this disease-condition. Preliminary investigations carried on by the speaker seem to point to the fact that the susceptibility of the chestnut tree to this fungus depends upon drought conditions; that is a low water content in the tree. This requires confirmation however by further detailed experiment. Weather conditions causing winter injury as suggested by Dr. Clinton may quite possibly be of importance also in this connection, and accurate data concerning past weather conditions and experiments to determine the effect of low temperature on the chestnut tree in connection with the production of susceptibility is highly important.

If the results of Dr. Munch on the cause of susceptibility and immunity of forest trees to disease should prove true in the case of this disease also, we may hope to be able to control the bark disease in shade, lawn, and park trees, by keeping up the water content of the tree.

Whether nursery stock serves to introduce the disease into new localities is an important problem to be determined by observation and experiment. The present method of inspection and cutting out would be inefficient if the fungus lives commonly as a saprophyte at the base of the tree on dead bark and can attain a parasitic habit with some slight change in weather conditions. If, on the other hand, it exists only as a wound parasite, then inspections would be possible and the cutting out method effective. However, with such problems as these undecided, no one can pronounce definite judgment upon the efficiency of the cutting out method. Once however, these facts are established, modifications may be made in the present method by which its effectiveness may be insured at possibly a lower cost than can now be expected.

The present method which the Pennsylvania Commission has adopted of eradicating only spots where the fungus is distinctly parasitic, can accomplish a great good in a sanitary way, and once sufficient facts are forthcoming, the method may be altered to suit our knowledge and thus its efficiency assured.

THE CHAIRMAN: The next paper, entitled "Recent Notes on the Chestnut Bark Disease," will be delivered by Professor H. R. Fulton, Division of Pathology, Pennsylvania State College.

RECENT NOTES ON THE CHESTNUT BARK DISEASE.

BY PROFESSOR H. R. FULTON, *Pennsylvania State College, State College, Pa.*

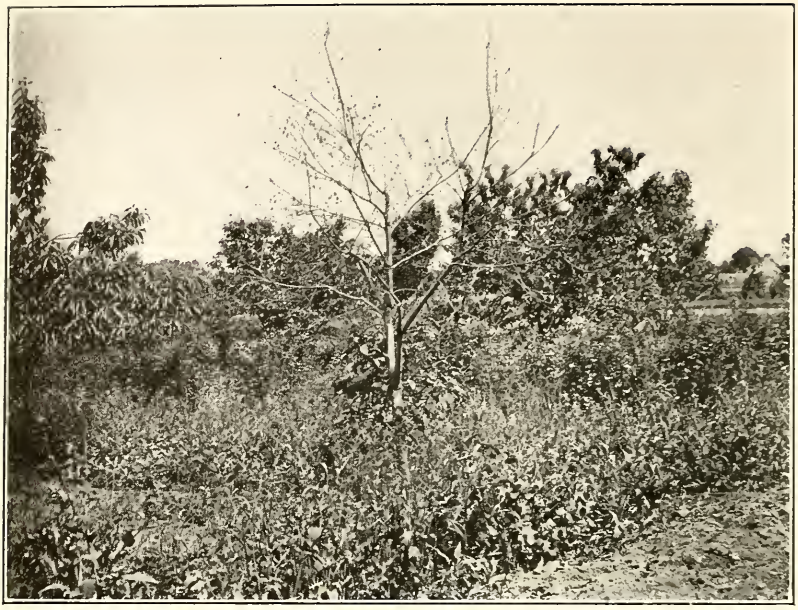
The steady and devastating spread of the chestnut bark disease brings us face to face with a grave situation, and raises many questions of great importance. Most of these will centre about the three great questions: Is it possible to check effectively

Orchard chestnut tree girdled at base, showing characteristic growth of sprouts. Scene near Westbury, New York.—*Photograph by Percy Spaulding.*

Large forest tree girdled at base, showing characteristic growth of sprouts; near Richmond Hill, New York.—*Photograph by Prof. Collins.*

Large trees with some branches girdled. Note condition of the foliage. Scene at Westbury, New York.—*Photograph by Prof. Collins.*

Large trees with some branches girdled. Note condition of foliage. Scene at Westbury, New York.—*Photograph by Prof. Collins.*



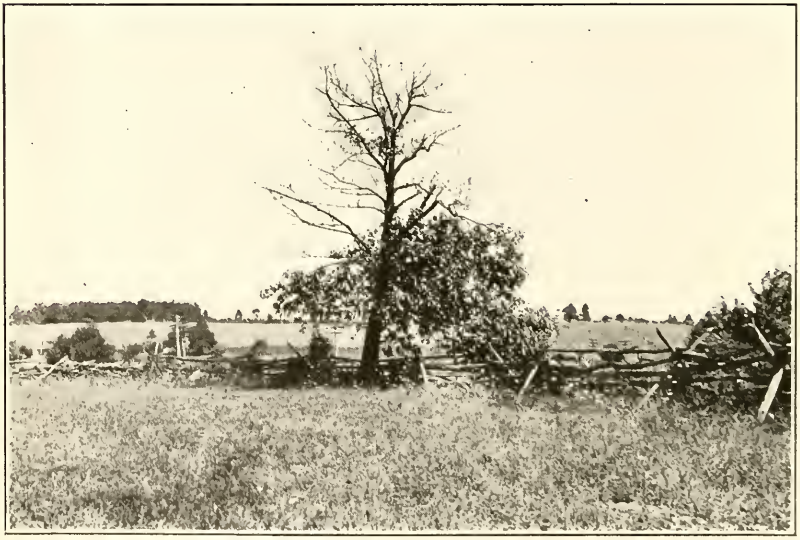
Orchard chestnuts, (grafted varieties), nearly dead. Note sprouts on the trunks. *Photograph by Prof. Collins.*

Orchard chestnut with limb girdled by twig-girdling borer. Easily mistaken at a short distance for chestnut bark disease.—*Photograph by Prof. Collins.*

Examples of tree surgery, showing healing process after cutting out cankers, in treatment of orchard trees. This treatment undoubtedly prolongs the life of the trees.—*Photograph by Prof. Collins.*

Example of tree surgery, showing healing process after cutting out cankers in treatment of orchard trees. Will prolong life of tree.—*Photograph by Prof. Collins.*

Chestnut tree showing early stage of disease; note small girdled twig on upper part of the tree in the centre of the picture.

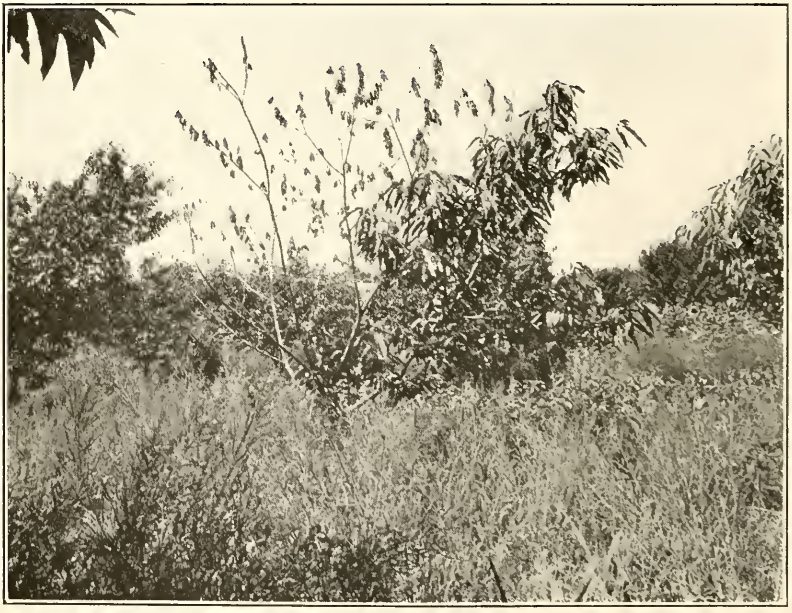


Large chestnut tree partly dead. Note sprouts with leaves near the top, the dwarfed leaves on the middle right-hand limb, and the healthy lower branches with normal leaves. Scene at Rawlinsville, Penna.—*Photograph by Prof. Collins.*

Early stage of infection in an orchard tree; note girdled twigs with withered leaves at top. Scene in Lancaster county, Penna.—*Photograph by Prof. Collins.*

Complete destruction of the chestnut trees in mixed stand. Note healthy condition of trees of other species. Views along Long Island Railroad, near Richmond Hill, New York.—*Photograph by Prof. Collins.*

Complete destruction of chestnut trees in mixed stands. Note healthy condition of trees of other species. Views along Long Island Railroad, near Richmond Hill, New York.—*Photograph by Prof. Collins.*



Small orchard chestnut nearly dead.—*Photograph by Prof. Collins.*

A dying tree on Long Island, New York.

Examples of tree surgery, showing healing process after cutting out cankers, in treatment of orchard trees. This treatment undoubtedly prolongs the life of the trees.—*Photograph by Prof. Collins.*

the spread of this disease? Is it worth while doing so? What are the best methods to use While no one, perhaps, will venture to prophesy the outcome, all doubtless agree that the great interests at stake justify an aggressive fight; and all alike are anxious to see the warfare waged in the most effective way. Other contests against fungous foes have been won in spite of apparently insuperable obstacles, and we now look back from the vantage ground of knowledge gained through the contests, and wonder that the tasks should have seemed hard. Each year witnesses the conquest of more than one important pest, just as each year is apt to bring into the limelight some hitherto unobtrusive pest. Mention might be made of scores of animal and plant pests that, in the wide interchanges incident to modern civilization, have been brought into contact with new host species, or with new environmental conditions, and have forthwith entered upon a period of riotous devastation. At the present time, federal and state resources are being drawn upon, and concerted state action is being had, in the fights against the gypsy and brown-tail moths in New England, and against the cotton boll weevil in the southwestern portion of the cotton belt. I cannot refrain from recalling to mind the eradication of the cattle tick in certain districts within its range, and the stamping out of yellow fever in territory under United State jurisdiction, as notable examples of success that has in recent times come from complete knowledge of the situations, combined with efficient administration. As a citizen of Pennsylvania, I take pride in pointing to the successful suppression of the foot and mouth disease of cattle, during 1908, by the State Livestock Sanitary Board in co-operation with the Federal Bureau of Animal Industry. These were campaigns of quarantine and sanitation.

These examples of very diverse nature do not prove anything in regard to the chestnut bark disease; but they do serve to emphasize the fact that persistent effort in the right direction may win in the face of great odds.

To the specialist in plant diseases, a most interesting question is, why is it that this disease has made such headway in this country in so short a time. Is it that there are factors involved, aside from administrative difficulties, that are not found in the many

fungous diseases that affect our crops,—less spectacular in their working, but none the less damaging in their effects? Or is it that well recognized factors are here found in a unique combination that adds to the seriousness of the situation? Is this disease inherently more serious than pear blight or cotton wilt or wheat stem rust? Answers to such questions involve consideration of the habits and value of the host plant, as well as definite knowledge on all important points in the life history of the causative organism, *Diaporthe parasitica*.

For chestnut bark disease infection to occur, three general conditions must be met just as for any other fungous disease. Broadly stated, these are (1) the presence of infective material, (2) a host plant in a condition of susceptibility, (3) general environmental conditions that are favorable. All rational control measures for the disease must be based on the peculiarities of this fungus with reference to these three things.

The infective material for *Diaporthe parasitica* seems to be pre-eminently the spores, which are of two types, the pycnospores, sometimes called conidia or summer spores, and the ascospores, or winter spores. We wish to know definitely the conditions that influence the formation of each type, the longevity of each under favorable and under unfavorable conditions, their modes of shedding and of transfer, the conditions favorable and unfavorable to their germination, their abilities to establish the fungus upon various materials, and the relative importance of the two types in spreading the disease. General environmental conditions may have their effect upon longevity of spores, upon germination of spores, upon rapidity of growth of the fungus, and upon spore production by the fungus. Susceptibility in the host has reference to qualities of genera or species or varieties or strains or individuals, that render them liable to attack by the fungus, which qualities may be inherent or possibly induced by environmental conditions. Here must be included the exposure through various wounds of susceptible portions of the host; and the protective effects of measures that may lessen the susceptibility of the host. Other points in the general life history of the organism may be of interest and importance, aside from any direct relation to the setting up of infection.

Realizing the importance to the public welfare of more complete knowledge along these lines, the Pennsylvania Agricultural Experiment Station, through its laboratory of plant pathology, has undertaken certain investigations upon the life history of *Diaporthe parasitica,* in hearty co-operation with the work of the Pennsylvania Chestnut Tree Blight Commission. While a complete report cannot be made, in the nature of the case, for a long time, we beg to submit a brief preliminary report on the laboratory work now being carried on by Mr. R. A. Waldron, of the Experiment Station staff; to which is added at the request of the Executive Officer of the Pennsylvania Commission, a summary of field studies made by Mr. R. C. Walton, one of the field agents of the Commission. Credit for the findings reported here is due to the careful work of these two men.

AIR CURRENTS AS CARRIERS OF THE CONIDIA.

The tests were made with the blast from an electric fan, with a velocity of perhaps twenty miles an hour. The material used was bark of chestnut with tendrils of conidia projecting from the mouths of the fruit-bodies. The tests were made with these tendrils dry, with them moist, and with the spray from an atomizer playing over them, the last to imitate conditions prevailing during storms. The attempt was made to catch the spores on the surface of sterilized potato agar exposed about six inches away, in the blast; and to determine the carrying power of the air current from the subsequent growth of *Diaporthe parasitica* in this material. Also, wet cotton was similarly held in the blast; it was then squeezed out in sterile water; this was centrifuged, and microscopic examination made of the sediment, as well as cultures from it. There was unmistakable evidence, from each line of testing, that the conidia may be detached by strong air currents, and carried short distances. The detachment was greater when the spray played over the material. The test will have to be carried further before quantitative results can be given. It seems likely that the detachment was largely of small bits of the tendrils made up of large numbers of spores, and that these are too heavy to be carried great distances; and suggests that under natural conditions infection may be spread short distances by wind.

LONGEVITY OF CONIDIA AND ASCOSPORES.

The length of time that conidia retain their power to germinate will doubtless vary with the conditions under which the spores are kept. Spores from bark collected in late summer and kept dry at ordinary room temperature, germinated readily for four months, but three weeks later could not be induced to germinate. Material exposed out of doors and that kept moist and at about 75 degrees F. in a greenhouse, did not give germination of conidia after four months earlier tests not having been made.

GERMINATION OF CONIDIA AND ASCOSPORES IN DIFFERENT MEDIA.

Both kinds of spores germinate in a decoction of chestnut bark, in rice broth, etc. Ascospores germinate in spring water, the conidia do not.

EFFECT OF TEMPERATURE ON GERMINATION.

Conidia germinate best at a temperature of 60 degrees F., and distinctly less rapidly at temperatures 10 degrees above or below this point.

Ascospores germinate best at a temperature of about 70 degrees F., but a good percentage of germination occurs at 85 degrees F. and 45 degrees F. Even at 38 degrees F. the germination of ascospores was 25 per cent. in the first 24 hours, and reached 70 per cent. in three days. Ascospores germinate readily after at least moderate freezing. These facts indicate that the ascospores may play a more important part in causing infection under certain conditions, than has been commonly attributed to them.

The effect of extremely high and low temperatures on spores has not yet been completely investigated in our laboratory.

EFFECT OF TEMPERATURE ON EARLY GROWTH.

In general the most rapid early growth is at the optimum temperature for germination. In a nutrient solution of boiled chestnut bark, the ascospores will send out a length of mycelium 10 to 15 times the spore length in the first 24 hours at 70 degrees F., which becomes an indefinitely large mass of mycelium in two days. At 38 degrees F., the growth is about one spore length the first day, and 15 times this in five days.

GROWTH ON OTHER MATERIALS THAN CHESTNUT.

In the laboratory the fungus grows well on a variety of artificial media, perhaps most readily on potato agar that has been made slightly acid. Material was submitted to us of white oak and black oak bark, collected by Mr. J. R. Guyer, agent of the Pennsylvania Commission, which bark had been killed by fire previous to its observation, and showed pustules of what seemed to be *Diaporthe parasitica*. Careful microscopic examination showed that the morphological features corresponded closely to those of *Diaporthe parasitica*, as did also the growth of the fungous in artificial culture. Red oak twigs killed by steaming in the process of sterilization, were readily infected by *Diaporthe parasitica* obtained from a typical chestnut lesion. While it is desirable to carry on further cross inoculation experiments, it seems reasonable to suppose, in the light of present evidence, that *Diaporthe parasitica* may, under unusual circumstances, establish itself saprophytically on portions of trees outside the genus *Castanea*, if these portions are already dead. We have found no evidence that the fungus produces in any sense a disease of such trees as the oak.

RELATION TO LIGHTNING INJURY.

In August, 1908, Mr. George Wirt, of the Pennsylvania Forestry Department, directed the attention of the speaker to a chestnut tree in an advanced stage of infection, that had been struck by lightning earlier in the season, when its leaves were half grown. Where the wood had been splintered along the lightning track, there were numerous pycnidia standing apart one from the other, as is characteristic of *Diaporthe parasitica* when fruiting on wood rather than on bark. Many of these fruit-bodies were deep in the cracks made by the lightning, and evidently had been formed after the stroke. Specimens taken from the wood and from the bark near by, when tested, gave good germination of spores. Probably the bark infection, which seemed to date far back, existed at the time of the stroke, and the fungus spread from this to the shattered wood, the lightning presumably not having killed the fungus in the vicinity.

DEVELOPMENT IN SAPWOOD AND HEARTWOOD.

Where a section of a large infected branch was kept in a moist atmosphere constantly, an abundant development of pycnidial fruit bodies was noted in about two months from both sapwood and heartwood at the more moist cut surface. The similar development in wood shattered by lightning has been mentioned above. In two cases, the fungus was found on young, unlignified shoots; in both cases, the parts had been distinctly injured by insects.

SUMMARY OF FIELD STUDIES AT ORBISONIA, PA.

During the fall and early winter of 1911-12, Mr. R. C. Walton made a detailed study of an advance spot of infection at Orbisonia, Huntingdon county, in Central Pennsylvania. The tract covered some forty-six acres on the north and northwest slope of a mountain. It had been cut over originally forty-five years ago, and at intervals since, the last cutting being in 1908. Most of the chestnut growth was coppice of four years standing. Rather severe fire injury had occurred in 1902, and the land had been pastured recently. Soil conditions and density of stand varied considerably over the tract. The infection was found in detached spots over about thirteen acres. There was one spot that seemed to be the original centre of infection, dating back two years; but elsewhere in the area there were lesions apparently as old. Altogether three thousand and fifty-nine chestnut trees, sprouts, and stumps were examined and two hundred and eighty, or 9.1 per cent. were found to be infected. Of these, practically all were four year coppice growth. The oldest lesions were seemingly two years old, and ten of these were found. The youngest were for the current season, and of the total, about half seemed to be less than one year old; and estimates of the age of all the lesions indicated a very uniform rate of spread during the two years. It may be added from a recent investigation that 153 trees in southeastern Pennsylvania, near Haverford exposed to natural infection, carefully examined and marked as uninfected in January 1911, showed 25 trees infected in a recent examination. This would indicate something, perhaps, of the rapidity of the spread of the disease, where observations were made upon that point.

Out of 18 sprouts showing two lesions, 13 had the younger lesion above and 5 the older, which might indicate the probable work of insects in carrying infection.

Sprouts were originally infected at the base in more than four-fifths of the cases. Forty per cent. of the oldest lesions on sprouts showed twigs as a centre of infection; eighteen per cent. showed cracks, fourteen per cent. wounds; thirteen per cent. beetle holes, eleven per cent. crotches, and four per cent. were indeterminate.

More infections were found in medium dense growth than in dense growth, and very few in rather open growth. Of all infections recorded, 47.3 per cent. were within twenty feet of old logging roads, 7.4 per cent. from 20 to 50 feet away, and 45.3 per cent. at greater distance. Many more infections were found where soil conditions were moderately moist than where they were dry. Of 150 original sprout infections, 62, or 41 per cent. had a north to northeast exposure; 20 or 13 per cent. a south to southwest exposure; and the remainder were about equally divided between the other two quadrants of the compass. This might suggest moisture again as an important factor.

There were 28 cases of pycnidia observed developing on wood. Only eight trees larger than seven inches in diameter showed infection. One of these had a lesion apparently two years old; and half had the oldest lesion less than one year old. All of the tree infection was in the bark of the trunk, none in the tops. Half had development of watersprouts in connection with the lesions. Lesions in the bark of stumps showed fissures at their centres in almost all cases, and in the oldest ones the pustules were usually dark and in the ascus stage.

In connection with lesions on sprouts, trees, and stumps, there were abundant evidences of animal association, principally beetle and other large insect larvae, tunnels and holes; but also woodpecker holes and claw marks, and ant nests and trails. Most of the ant nests were in old dried stump stubs. Fully nine-tenths of all old lesions showed beetle larvae in or near them. These were mainly a species of Leptura. Of the youngest lesions, about two-fifths showed larvae in or near them; and in all cases

there were about twice as many larvae in as near the lesions. It would seem that these usually follow rather than precede the infection.

Woodpecker work was noted in about one-tenth of the oldest lesions, and not at all in the youngest lesions,—much less frequently than beetle work. Ants were seldom found actually in the lesions.

It is expected that careful observations of this same tract next year and later, will add much to the value of the present very complete records, which it has been possible to summarize only briefly in this account.

A good deal is known about this parasite; very much remains to be learned. As far as our present knowledge goes, the prompt stamping out of advance spots of infection, and the general cutting off of hopelessly infected tracts, seem to be the only practicable means of control. No one perhaps realizes more keenly than the speaker the difficulties of finding infection and thoroughly removing it in sparsely settled tracts of large extent and of little value for timber. I have had occasion this last summer to be on the outskirts of the line of spread of this disease through the State, and I have seen numbers of these advance spots. It seems that if we can find these spots and remove the timber, we will be doing much to check the advance of this disease. In this State the fight is on, and it is the part of all good citizens to cooperate in the work that is being done. (Applause).

THE CHAIRMAN: Dr. Caroline Rumbold, who is in charge of important research work at the laboratory of the University of Pennsylvania, will present a paper in relation to medicinal remedies for the chestnut tree bark disease.

THE POSSIBILITY OF A MEDICINAL REMEDY FOR CHESTNUT BLIGHT.

BY DR. CAROLINE RUMBOLD, IN CHARGE OF THE PENNSYLVANIA CHESTNUT TREE BLIGHT COMMISSION'S LABORATORY.

Mr. Chairman, Ladies and Gentlemen: Although in the programme, the title of my remarks has been given as the possibility of a medicinal remedy for chestnut blight, I much prefer to confine myself to a question of medicinal treatment as I believe it would limit me too much were I to try to discuss a remedy, a cure-all, one might say, when we have only started to work out the problems in the case. My main task is to attempt to find the relation between the chestnut tree and the fungus which causes its death; consequently my work is with individual trees.

The question of medicinal treatment should be considered broadly from two sides. Firstly, the side of securing better health conditions for the chestnut trees, in order that they may have the ability better to resist the disease. This we will call preventive treatment. Secondly, the aspect of curative treatment.

Under the first heading come the details of water, food, light, in other words, matters of environment. As for water, there is the question as to whether or not droughts of recent years are partially responsible for the spread of the disease in the chestnut tree. I am now conducting experiments in which chestnut trees are being exposed to infection under varying conditions from dryness to excessive moisture, both of atmosphere and soil. These experiments may also throw some light on the report that the blight spreads rapidly where trees are in a crowded coppice, while trees growing on the ridge of a hill are uninfected.

In the matter of food, various fertilizers are being subjected to tests on growing trees.

I am about to start a series of experiments in which young trees are to be grown in solutions of different chemicals, with the object of hastening the growth of the bark, or of increasing

the amount of chlorophyll in the leaves, in order to find out whether or not such variations as this might increase the immunity of a healthy tree. Under the head of preventive treatment is also to be considered the care of wounds, etc. This subject will be fully considered in this conference by other speakers. My own work in this direction is confined to the testing of "washes" submitted to the Pennsylvania Commission for trial.

If the question of preventive treatment is still so far from being satisfactorily answered, that of a curative treatment is in a more inchoate condition. At most, I can describe the methods adopted in the Pennsylvania Commission laboratory, and in which I shall attempt gradually to start experiments along the following lines:—Experiments to test the relative vitality of the mycelium of the fungus, its ascospores and the conidiospores found in summer and those formed on wood during the winter; injection into trees of chemicals toxic to the fungus causing the blight; tests as to the immunity of different varieties of trees. I have started some experiments along two of these lines, but none is completed. According to my experiments so far, the ascospores or winter spores seem to have the greater vitality; then follow the summer or conidiospores. The mycelium and those conidiospores grown on wood seem to be equally susceptible to poisons. The injection experiments which are to be made are those where chemicals are injected into roots and where hypodermic injections are made on the trunks of the trees. These are of necessity dependent on the experiments leading to the discovery of chemicals toxic to the fungus and not deadly to the tree.

Experiments as to relative immunity of chestnuts are now being conducted on two or three varieties of trees. Japanese and American trees have been inoculated with the blight. For the purpose of such experimentation, the Commission has been given the privileges of the Botanical Laboratory of the University of Pennsylvania, where a special room has been set aside for my work. A greenhouse has been recently completed, in which a number of small chestnut trees are now growing.

THE CHAIRMAN: The next paper is entitled "Treatment of Individual Trees," by Professor J. Franklin Collins, United States Department of Agriculture.

TREATMENT OF ORCHARD AND ORNAMENTAL TREES.

BY PROFESSOR J. FRANKLIN COLLINS, U. S. DEP'T OF AGRICULTURE, WASHINGTON, D. C.

Mr. Chairman, Ladies and Gentlemen: For the purpose of calling your attention to one or two points that I want to emphasize as a preliminary to my main topic, I will quote the opening paragraphs of a story published in the fall of 1910 in a well known popular magazine. The particular incident may or may not have been true, it doesn't matter, still, all who have had much to do with the chestnut bark disease will recognize the incident as a fairly typical one, with perhaps a slightly different setting.

The programme of experimentation thus outlined seems formidable, but this work must be thorough if any results of value are to be obtained. It can be said that nearly all of these experiments point to the possibility of curing infected chestnut trees. Perhaps by the end of another year the Pennsylvania Commission laboratory will be able to report, if less of a forward looking programme, at least more of actual and valuable results. (Applause).

"A tall, lean man, with a grizzled beard and the air of wisdom that goes with such adornment, strode across the lawn of an old fashioned Connecticut country seat, and gallantly lifting his dingy Panama hat to the mistress of the manse, said in impressive tones:

'Madam, I have just been looking at your chestnut trees. They are all covered with scale, and are dying. I can save them, if you wish to have it done.'

'Can you?' said the credulous woman, looking up to the dead top of a noble tree. 'I have noticed that there was something the matter with them. How much will it cost?'

'Let's see,' mused the tree-doctor. 'Eleven trees, two dollars apiece. Well, I'll make it twenty dollars for the lot. They're worth more than that to you, ain't they?'

'I should say they were,' said the owner of the estate. 'My husband said before he died that he wouldn't take five hundred dollars for that big chestnut out in front there. I will willingly pay twenty dollars to have them saved.' 'All right. Let me get my outfit.'

He went to his buggy, brought back a paper bag of powder and a whitewash brush, and borrowed a pail, some water and a step-ladder. In an hour he had swabbed the trees from as high as he could reach from the ladder down to the ground, pocketed the pleased widow's twenty dollars, got into the buggy, said 'Gid-dap' to his horse, and was down at the next door yard, swabbing more trees and pocketing more dollars."

It is true that many unscrupulous persons have been making money in a manner similar to the one mentioned in this story. It is true also that the ravages of the disease, and especially the legislative appropriation to combat it in Pennsylvania, have suddenly brought to light numerous unsuspected infallible cures for all the ills (including the chestnut bark disease) to which trees are or ever will become heir, if we should judge only from the statements of the advertisers and inventors.

Apropos of this, the Chestnut Tree Blight Commission of Pennsylvania might relate some of their experiences along this line that would make more interesting reading than the above, though the incidents were less profitable financially to the fakirs.

The main point that I want to emphasize, however, is that the value of ornamental trees cannot, like forest trees, be gauged by the mere timber value of the wood, nor, like the orchard tree, merely by the value of the annual crop of nuts. The chestnut tree undoubtedly attains its highest value as an ornamental tree. You will all recall, I am sure, certain estates where one or more chestnut trees are the main aesthetic or decorative features. Perhaps the tree may have been a veteran, famous in the countryside, long before the present owner purchased the land and built his domicile. Oftentimes the value of the ornamental tree is largely enhanced by its location with reference to the house, and even more largely, at times, by historic or ancestral traditions with which it may have been, long since, associated. The value placed by the owner of the estate upon such tree may occasionally be almost without limit.

The very fact that the tree is of much greater value to its owner than any tree in the forest could be, means that more labor and more care, can and will be expended upon it, if it needs it, than would be considered possible, from almost any economic point of view, on either the orchard or the woodland tree. Consequently some methods of combating the disease may be profitably applied to ornamental trees that would not for a moment be considered in connection with a tree in the forest.

At the very beginning of the experimental work undertaken by the United States Department of Agriculture, this fact was recognized, and has since been kept in mind. Considerable of the experimental work has had for its main object the solving of the problem as to whether or not it will be possible to eradicate or control the disease on individual trees.

Notwithstanding the fact that much of this work has been done in chestnut orchards, there are probably few orchard trees that would be worth the expense involved in an attempt to save them; however, on account of their smaller size and greater accessibility, they would be more profitable for individual treatment than the forest tree. Consequently these orchard trees become, in most cases, nothing more or less than experimental martyrs for the possible future benefit of their more aesthetically valuable ornamental kin.

It is yet much too early to make a very definite statement, certainly not a final report, upon the possibilities of being able to control fully the Chestnut Bark Disease on ornamental trees without recourse to the radical methods at present advocated for controlling it in a woodland. Nevertheless, certain facts have been repeatedly demonstrated in the course of the experimental work which apparently point in a very encouraging manner to the probable ultimate accomplishment of this highly desirable end though perhaps not on a very encouraging economic basis, as such a basis is usually figured.

I want to call your attention to some of these facts, as well as to the bearing that they may have upon control work of this general character. But in order to make clear certain points I must first refer very briefly to the general line of treatment which is being followed in the experimental work mentioned.

This has been fully described in Farmer's Bulletin No. 467, of the United States Department of Agriculture, and need not be considered in its entirety here.

For this work the most essential implements are a gouge, a mallet or hammer, a pot of tar or paint, and a brush to apply the latter; also a whetstone for keeping the gouge sharp. When a diseased spot in the bark is located, it is carefully cut out with the gouge and mallet, care being taken to cut the bark perhaps one-half inch beyond the discolored area which is usually so prominent a characteristic of diseased bark. It is extremely important that the gouge be kept scrupulously sharp. If it is dull, the pressure required in forcing it through the bark will invariably result in some injury to the delicate cambium cells at the edge of the cut. This means that the new growth will start back under the bark some distance, an eighth, a quarter, a half inch, or even more, and not close to the edge of the cut, where it should start under the most favorable conditions.

During the growing season the new growth begins to lift the old bark within a week or ten days. If this growth does not begin close to the edge of the cut, we shall find in the course of three weeks, under the uplifted edge of the bark, the finest kind of a shelter for all kinds of small grubs, beetles, etc.; all of which are well known danger factors in connection with the spread of the disease.

At most seasons of the year, it is highly important that the edge of the cut along the cambium line be covered with paint or tar as promptly as possible. This is an important, and often essential, point in coaxing the new growth to start closer to the edge of the cut than it ever would under perfectly normal conditions. By using a sharp gouge and promptly covering the cut edges, we have many times had the satisfaction of seeing the new growth start within a thirty-second of an inch of the edge of the cut, and be readily visible to the unaided eye in less than a week. Anything better than this can scarcely be expected. Of course, all portions of the cuts must be finally, carefully and completely painted with tar, paint, or other suitable waterproof coating, and it is, theoretically at least, a good plan to paint the cut surface with copper sulphate or Bordeaux before waterproof coating is applied.

In discussing the possibilities pro and con of controlling the disease on individual trees after it has become established, there are many factors that should be clearly understood and carefully considered. It should be determined just what bearing each will have on the main problem, just how each unfavorable one can be overcome or at least neutralized, just how each favorable one can be made even more helpful in the fight; all these, and more, if we are to enter the combat fully equipped. From numerous points of view it is extremely unfortunate that the disease has spread with such rapidity from its first known centre, that nearly every person who has been detailed by the States or the Federal Government to work on the disease has, of necessity, been obliged to devote most of his energies to locating or destroying infected trees, and relatively little or none to the research or investigation phase of the problem.

Everybody who has had much to do with the disease will agree with me, I am sure, when I say that in our efforts to control it we have been enormously handicapped by lack of just such knowledge as comes only from systematic and painstaking research. If we had this knowledge at the present time we would undoubtedly see with clearness many things which are now shrouded in the mistiness of uncertainty or in the darkness of complete ignorance. Who, I wonder would venture to foretell the effects upon the whole question of control if we had spread before us a complete, or fairly complete, positive knowledge of the many important points connected with the disease, about which we now know so little: e. g., to mention a few of these, its origin, methods of dissemination, detailed effects upon the host, immediate cause of the death or the lost vitality of the spores, resistance of spores and mycelium to toxic agents, climatic influence upon host and disease, the extent to which it is possible artificially to introduce various fluids into the circulatory system of a tree without killing it, the extent to which insects are responsible for the spread of the spores, the precise knowlege of the relation of birds, rodents, wind, etc., to dissemination of the spores.

In attempting to control the disease on individual trees, there are certain facts, as I have already stated, which have been re-

peatedly demonstrated in the course of experimental work, that are worthy of consideration at this time. I want to mention and very briefly discuss six of these:

(1). Lateral or oblique conduction.

There seems to be a rather widespread (but erroneous) idea that the crude and elaborated sap of a tree can pass up and down the trunk or branch only in a longitudinal direction, that is, lengthwise of the fibres or "grain" of wood or bark, or at most with but slight deviation from this route. The fact that it is transferred almost entirely in a longitudinal direction in a healthy uninjured tree may be true enough under normal conditions, but it is far from true in trees that have been injured in certain ways, and, as all students of plant physiology know, not strictly true under perfectly normal conditions.

It is a fact of common knowledge that a tree will ordinarily cover or grow over, an area of bare wood where the bark has been removed. It is common knowledge to all observant persons that these scars heal over mainly from the sides. In all probability this is largely because they adjoin the uninjured vessels through which sap is being conducted in the normal longitudinal direction, but doubtless in part also to other causes to which I shall allude directly. If a partially or entirely healed over scar should be dissected, it will be found that in the layers of wood formed immediately after the injury the fibres are curved outward around the injury, and continue in a nearly longitudinal direction both above and below the scar. When the scar is partially covered, the newly formed fibres are straighter, and finally after the scar is entirely covered, the youngest fibres will be found to have assumed their normal longitudinal direction, or very nearly so.

If it were not for this possibility of oblique conduction, a tree that had a large lesion extending half way around the trunk on the north side, for instance, and an equally large one on the south side, either above or below the other, would, to all intents and purposes, be girdled.

In the chestnut tree, the angle from the perpendicular to which these fibres can be made to curve, as a result of experimental cuttings, may seem surprisingly great. In one instance the

writer very nearly succeeded in an attempt to force this new growth to produce fibres at right angles to the normal direction: i. e., they were made to bend more than 80 degrees.

The fact that new fibres can, if necessary, be formed at such a great angle from the normal is of very great advantage to the chestnut in the process of healing over scars made, for example, by cutting out diseased spots in the bark. As food is conveyed through a plant in very dilute watery solutions, it is necessary that a great amount of sap be circulated or conveyed to a point where any considerable amount of food is demanded. If the tubes which primarily convey sap should be severed, as when a diseased spot has been cut out of the bark, the free transfer of sap is at most seasons of the year immediately reduced to a minimum in the severed or "dead ends" of these sap conducting tubes, which from the point of view of circulation, now hold about the same relation to the uninjured tubes that the stagnant arm of a river does to the main river.

So far as the actual food is concerned, it is obvious that the amount of sap necessary to supply the requisite food cannot reach the upper and lower edges of a scar by means of the dead ends of the conducting tubes as readily and rapidly as at the edges where there is a continuous stream of sap passing along the uninjured tubes.

Oftentimes just below a broad scar which reaches to the wood, and less often above it, a triangular piece of bark will die. This is due directly or indirectly to the inability or great difficulty that the sap has in reaching these places. In order to preclude the possibility of the bark dying back either above or below a scar, and thus furnishing favorable shelters for insects, the top and bottom of the scar should be pointed instead of allowed to remain abrupt or rounded. Under ordinary conditions it takes no longer for a scar six inches long and an inch wide to heal over completely than it does for one an inch long and an inch wide, simply because the healing over depends almost entirely upon the growth at the sides of the scar. As I have already intimated, all cuts should be made with instruments that are kept very sharp.

(2). Mycelium in the wood.

The mycelium of the fungus almost always produces a very characteristic mottled fan-like appearance in the bark, and appears to penetrate through the tissues of the bark but a short distance, if at all, beyond this discolored area. The mycelium also penetrates the sapwood very freely, when the disease reaches as deep as the wood, as it generally does sooner or later; but, unlike its effect in the bark, no pronounced discoloration is produced in the wood, and it is impossible to determine with the unaided eye the approximate limits of the mycelium, as in the case of the bark.

In all efforts to control the disease without destroying the tree, it is of course necessary to gouge out this disease infected sapwood. The depth to which it is necessary to remove it cannot at present be definitely stated, as insufficient time has elapsed to demonstrate this point experimentally. Many cuttings, some with the sapwood partially removed from beneath a lesion, and others with all of it removed, are now being watched for results. However, in a diseased spot from three to four inches in diameter apparently at least three annual layers of wood in the centre of the diseased spot must be removed.

Of course where sapwood is cut, enormous numbers of minute tubes, which conduct the crude sap from the roots through the trunk and branches to the leaves, are severed, and, should the cutting happen to have been done during warm, dry weather, it often happens that one or more branches directly above the cut-out area will show much wilted leaves within an hour or two. This is a direct and inevitable result of the suppression, from any cause whatsoever, of a considerable portion of the supply of water for the leaves.

Considerable careful judgment may at times have to be used when making cuts of this nature, and occasionally it may be wise to remove one or more healthy limbs, or perhaps to strip the foliage partially from a branch situated just above a place where much sapwood has been removed. This will at least tend to prevent wilting, which if excessive, may result in the subsequent death of the branch.

(3). Preservation of exposed wood from decay.

If exposed surfaces of wood are left with no protective covering they soon become weathered, dried, checked, and easily infected with fungi, causing decay of the wood. In the chestnut,

moreover, there is the additional danger of infection from the spores of *Diaporthe parasitica*. In order to reduce the chances of infection from wood rotting and other fungi, it has been the prevailing custom for many years in this country as well as abroad, to paint all exposed surfaces of wood with tar or lead paint. Judging from our own experience perhaps these are as good general preparations for this purpose as any that we care to recommend at this time, though they are not ideal and they do not prevent the checking of the wood. Morever, they must be renewed from time to time in order to accomplish permanent good. Creosote is excellent for a preliminary coating, but it sinks into the wood readily and apparently has waterproof qualities of only temporary value. It should always be followed (within a few days, for example) with some thick or heavy coating, such as tar or paint.

For preventing the drying back of the cambium layer at the edge of a cut, we have so far found nothing better than orange shellac. This does not long remain a waterproof covering under ordinary conditions, and should, as in the case of creosote, be covered with a heavy coating of paint or tar, say within two or three weeks after it is applied. Many other preparations for covering exposed wood have been tried, but those mentioned appear to have been the most satisfactory from the point of view of our experiments on ornamental and orchard chestnut trees.

(4). Sanitation.

In cutting out diseased spots in the trunk or branches of chestnut trees, the chips should be carefully gathered in papers, or better, paper bags, and destroyed by burning. They should not be left scattered about on the ground. In other words, sanitation is one of the essentials for success in this kind of work, just as it is in the case of diseases of human beings. In all of our experiments with the disease on one particular plot the chips were left where they fell. No attempt was made to destroy them. Later many of these chips were examined and apparently good, though dormant, fruiting pustules were present in the majority of cases. To take one particular case: In March, 1911, some diseased spots, with good fruiting pustules, were cut from a chestnut tree and the chips left on the ground in a sunny exposed place on a dry hill-top. These remained on the ground

throughout the spring, through the hot dry weather of early July, and the drought of July and August. In early September, two days after the almost unbroken week of rain during the latter part of August, these chips were again examined, and on a few of them which were composed entirely of bark, two or three inches long and half as wide, many spore threads were found. These, remember, from chips that had been lying on the ground for more than five months through the hot summer drought. Possibly this may be regarded as an extreme case, but in any event it clearly emphasized the necessity of extreme care in destroying all diseased bark, chips, etc., in all attempts to control the disease. Again, extreme cases of the sort mentioned are often the very ones that must be guarded against. In certain instances a gasoline torch has proved an efficient adjunct for the burning out of the diseased spot and thus destroying the fungus, whether or not followed by the gouge and mallet.

(5). Insects.

Soon after beginning work on the disease in 1908, our attention was irresistibly drawn to the evident intimate relation that insects bore to the spread of the disease. It is singularly interesting to note that practically every person who has been working on the disease in the field for any length of time has, sooner or later, been strongly impressed with this very apparent interrelationship between insects and the chestnut bark disease. Personally, we have made many observations upon the topic, but as this work properly belongs to another Bureau of the U. S. Dept. of Agriculture, we have limited our work to observations. Here is a phase of the work that could easily influence the plans of control to a large extent if we knew absolutely the relation of insects to the disease. It is gratifying to know that the Commission has an expert entomologist already at work on this particular part of the general problem.

(6). Immunity.

From what is now known regarding the spread and virulence of the Chestnut Bark Disease, there seems little immediate promise of individual trees or variations of the American Sweet Chestnut *(Castanea dentata)* developing immunity. As this species is the only forest tree of the genus in the country, it

would appear that the question of immunity can have practically no direct or immediate bearing upon the saving of our forest chestnut trees.

At the present time there is every prospect that we can reasonably expect to procure immune pure bred varieties or species of chestnuts from northern Asia and Japan. Indeed, we already know that some of the Japanese and Korean chestnuts are almost, if not quite, immune to the disease. I think it is safe to say, where Japanese varieties have been killed by this disease, that in more than ninety per cent. of the cases which have come under our personal observation, the trees have been grafted with Japanese scions on American or European stocks, and the Japanese trees have been killed by girdling below the graft. We have repeatedly observed such cases where the stock has been absolutely covered with disease up to the graft line, with not a sign of it anywhere on the Japanese portion. Naturally, this fact in itself is strong proof of the immune nature of these particular Japanese varieties. As these highly resistant, or perhaps immune, trees are with us small, and the nuts, though often huge, are of inferior quality, their value will be almost entirely as ornamental trees, and probably never, in our time at least, of any value in replacing the American chestnut. If the better flavored native and Paragon nuts should disappear from the market, we would doubtless soon turn to the inferior Japanese nut as a substitute.

In recent years much has been accomplished along the line of breeding hybrids or strains of plants which are not only often fine in quality, but also highly resistant to disease. The results that have been attained in this direction within a comparatively few years are truly gratifying, but the future will witness greater results. There is no reason to doubt that we may eventually see an immune hybrid chestnut that will rival the American sweet chestnut in flavor of the nut, and the Paragon in size.

THE CHAIRMAN: You will recall that, while we were listening to the addresses in response to the remarks of Governor Tener, the gentleman from Connecticut stated that he had

some results which he desired to present to us at sometime during the Conference. It has been suggested to me that, as it is a little late, it would be best to put over all general discussion until this evening, when we are to have only one set paper and at this time to call upon the gentleman from Connecticut, Professor Clinton, who has his results in the form of two short papers. If that meets with your approval, then, we will ask Professor Clinton to speak at this time. He is not "a long, lean man with a grizzled beard," but he has some other points that will commend themselves to us. (Applause).

PROFESSOR GEORGE P. CLINTON (Botanist, Connecticut Agricultural Station): Mr. Chairman, Ladies and Gentlemen: The first paper that I will present is written by Professor Farlow, of Harvard University. For the benefit of those who do not know Professor Farlow, I will say that he is the oldest mycologist in this country, has had the greatest experience in studying fungi and has some of the best herbaria dealing with fungi, especially those bound in book form, known as Exsiccati, in the world. He took up the study of the nomenclature of the chestnut blight disease, at my request, about two years ago. He has not supplied a title to the paper which I will now present.

PAPER BY PROFESSOR W. G. FARLOW, HARVARD UNIVERSITY, MASSACHUSETTS.

The cause of the disease of chestnut trees prevalent in our Eastern States is ascribed to the growth of the fungus named *Diaporthe parasitica* by Murrill in 1906. If as is generally believed, this fungus is the cause of the disease, in searching for the best method of combating it we not only should obtain all the information possible in regard to the microscopic structure and pathogenic action of the fungus, but we should see whether we may not get some practical suggestions from what has been written in regard to the distribution and pathological action of fungi which are most nearly related to our chestnut fungus.

The first question we may ask is: Is *Diaporthe parasitica*, as at first supposed, really a species new to science? If so, is it a native species which has hitherto escaped the notice of our mycologists, or has it been introduced from some other country? In disease due to fungi the presumption is always in favor of the

theory that they have been introduced when they produce sudden and virulent epidemics, as in the case of the potato rot. The presumption, I say, is in favor of this theory, but a presumption it should be borne in mind is not a certainty. If *Diaporthe parasitica* is not a species new to science, what is it, and where did it come from? The microscopic structure of the chestnut tree fungus as we now know it, is well known, and its habit and its reproductive organs have been described and figured in many publications accessible to everyone. What, however, is not so generally known is what has been written in times past on fungi found on chestnut trees in different countries, and a review of what is known to mycologists in this connection may be instructive although, it must be admitted, the subject is not very easy to follow. On account of dried specimens in the older herbaria and a summary of the often obscure and conflcting descriptions to be found in old treatises, even if desperately dull, will enable us to form certain practical conclusions.

When I first received fresh specimens of the fruiting fungus of the chestnut tree I was struck by their great resemblance to what is generally known in American herbaria as *Endothia gyrosa*. Unfortunately most of the specimens of that species in herbaria are sterile and from the habit alone one cannot be sure of the species of a fungus of this group. The fresh fungus also recalled a specimen I had seen in an Italian collection, and on looking it up and comparing it miscroscopically with the fresh material, I found the two to be identical. The gross structure and the characters of the spores and asci were the same in both. The Italian specimen to which I refer is No. 986, First Series of the Erhario Crittogamico Italiana, issued in 1863. The label states that the fungus grew on chestnut trunks at Locarno on Lake Maggiore, where it was collected by Daldini in 1862. The name there given is *Endothia radicalis,* but the question of the name need not be considered at present. As other botanists have examined the specimen just mentioned and agree as to the identity of the *Endothia radicalis* and the *Diaporthe parasitica,* some having already expressed their opinion in print, we may state definitely that our American chestnut tree fungus does not appear to be new but to have been known on chestnuts in Italy fifty years ago.

It may be well to glance at what has been written on the subject in Italy. The earliest reference known to me is that of Rudolphi in Linnaea, 1829, where the *Endothia* is said to grow on *Quercus Ilex, Q. pubens* and *Castanea vesca.* Later accounts were given by Cesati and De Notaris in 1863 in their Schema and the Sphaeriacei Italica, where there is a good description and a rather crude figure apparently drawn from somewhat immature specimens, for the spores are represented as one celled, although in the description they are said to be sometimes obscurely two-parted. The fungus is said to be common on dried branches and denuded roots of oaks and chestnuts in Northern Italy and to occur also on elms.

Italian specimens were distributed in Rabenhorst's Herbarium Mycologicum, Thuemenis, Mycotheca Universalis and Saccardo Mycotheca Veneta; but in the copies which I have examined the specimens had spermogonia but no asci. The most recent notice of the fungus in Italy is that of Traverso in Flora Italica Cryptogama, in 1906, who uses the name *Endothia gyrosa.* It is said to grow on Aesculus, Alnus, Carpinus, Castanea, Corylus, Fagus, Juglans, and Quercus, and to occur not only in Europe and North America but even in Ceylon and New Zealand.

We have early notices of the fungus in France. In 1830 Fries stated in Linnaea that he had received it from that country and Tulasne in his Carpologia, Vol. II, 1863, gave a long notice of the fungus, which he says grows on Carpinus, with critical notes on the synonymy of the species. In 1870 Fuckel recorded its appearance as rare on Alnus at Oestrich in Nassau, and Winter, in 1886, in Rabenhorst's Crytogamen Flora, stated that the *Endothia* grew on different deciduous trees in Germany. The records of the fungus in France and Germany are less satisfactory than its record in Italy, and the specimens distributed from the former countries in exsiccati are few and poor.

From this rather long account of the history of the chestnut fungus in Europe, we may draw the following conclusions: Our chestnut tree fungus is widely spread in Europe and is common in Northern Italy, where it was first noticed as long ago as 1829. It is of interest to notice that writers are very generally agreed that it grows on bark, dried branches, and dead roots, rather than on living branches, and the hosts on which it is said to grow

are not merely chestnuts and oaks but a considerable number of deciduous trees. Yet, although the fungus has been so well known in Italy, where it is in some places certainly common, there is no record whatever of any serious disease of the chestnut due to it. The chestnut, which is a tree of great economical importance in Italy, is subject to a good many diseases which have been carefully studied by the Italian pathologists but, so far as I know, not one has suggested that any is due to the Endothia. Were it a fact that the Endothia, whatever specific name we please to call it, is a species endemic in Italy but not found in North America until the appearance of the present epidemic, we could understand why the fungus might cause a serious disease in this country although it causes no trouble in Italy, for, if infected plants were imported from Europe, the fungus, as in other well known cases, might be transferred to our native chestnuts which unlike the chestnuts of Italy have not become immune.

Italian botanists did not and do not regard their chestnut Endothia as merely an endemic species but consider it to be the same as *Sphaeria radicalis* described by Fries in 1828 from North American specimens collected by Schweinitz. We learn from Schweinitz, in his North American Fungi, that the species was very rare on roots of Fagus in North Carolina. The synonymy is too complicated to be followed here but some reasons why it is so complicated should be stated. Prior to the publication of *S. radicalis,* Schweinitz had in 1822 described a *Sphaeria gyrosa* from North Carolina said to grow on Fagus and Juglans. Later Fries made this species the type of a new genus, Endothia. The earlier Italian writers regarded *S. gyrosa* and *S. radicalis* as two distinct species, apparently basing their opinion on the fact that Fries placed the two in different sections of the old genus *Sphaeria* rather than on an examination of American specimens of the two species. Traverso and some later writers, however, consider that the so-called two species are really only two different stages of a single species. It appears to me that their opinion is quite possibly correct, but the question can be settled definitely only by an examination of original Schweinitzian specimens. Thanks to the kindness of Dr. Stewartson Brown I have been allowed to examine the specimens in the Schweinitzian Herbarium in the Academy of Natural Sciences

in Philadelphia, and I have also examined Schweinitzian specimens in the Curtis Herbarium at Harvard. Unfortunately I have not as yet succeeded in finding a Schweinitzian specimen of *S. radicalis* which shows ascospores; possibly none of the so-called *S. radicalis* has ascospores, but I am not yet certain that that is the fact. Specimens supposed to be *S. gyrosa* are common in American herbaria and have frequently been distributed in different sets of exsiccati. Unfortunately of the considerable number of specimens I have examined, the greater part were sterile although judging by the habit alone, they might very well be *S. gyrosa*. I have, however, seen no specimens in the older American herbaria where the fungus supposed to be *S. gyrosa* was certainly growing on chestnut. In general the hosts were not specificially stated but a large per cent. were evidently on oak. There is a fungus common on oak in the Southern states which has the external habit of Endothia, and appears frequently in herbaria as *Endothia gyrosa*. An examination of a number of fertile specimens on oak from different localities, having all the appearance of being *E. gyrosa*, has shown that the ascospores are unlike those of the Endothia of Northern Italy or like those of what is called *Diaporthe parasitica*. Stated in words the differences may seem to be slight but in practice one can without difficulty distinguish the two. The spores of the form on oak have hardly half the diameter of those of the chestnut and the spores are nearly linear. Naturally no definite account of the spores was given by Schweinitz and therefore except by an examination of authentic specimens we are not able to say whether the form on oak should be considered the true *S. gyrosa* of Schweinitz or not. As I have said, I have not yet been able to complete my examination of original material, not as yet having found mature *S. radicalis*.

Although further examination is necessary before expressing a final opinion, certain facts seem to be settled. Our form on chestnut called *Diaporthe parasitica*, described in 1906, and that on chestnut in Italy collected by Daldini in 1862 are identical as far as can be determined by a study of the dried, herbarium specimens which we have been able to examine. As far as I have been able to examine the older herbaria, I have found no specimen of Endothia on chestnut in North America. There is, how-

ever, an Endothia on oak not uncommonly found in fruit in the Southern States which has spores which seem to me to be specifically different from those found on the chestnut. The question, however, is still open as to whether the form on chestnuts may not also be found on oaks on further examination. If so, however, it must be less common, if I may judge by the considerable number of specimens I have examined, than the form with narrow, linear spores.

DR. JOHN MICKLEBOROUGH, of Brooklyn: Mr. Chairman: I would suggest that Professor Clinton be given the first opportunity to present his own paper the first thing this evening. We have had a very long session, and I think the time has come for adjournment.

THE CHAIRMAN: That seems an excellent suggestion. What is the pleasure of the Conference? Is there objection to it? If not, then, Professor Clinton, if it is agreeable to you, we will ask you to present the other paper the first thing this evening.

The Chair will remind you, gentlemen, that you are invited to register and he would state, also, that the Committee on Resolutions will be announced to-night. We will then now stand in recess until sharp at eight o'clock, when we will again meet in this chamber.

EVENING SESSION.

Tuesday, February 20, 1912, eight o'clock P. M.

THE CHAIRMAN: Gentlemen, the meeting will please be in order. We will first hear the short paper that we had expected to hear at the close of the afternoon session, by Professor Clinton. (Applause).

SOME FACTS AND THEORIES CONCERNING CHESTNUT BLIGHT.

BY PROFESSOR GEORGE P. CLINTON, BOTANIST, AGRICULTURAL EXPERIMENT STATION, CONNECTICUT.

Mr. Chairman, Ladies and Gentlemen:—

At a recent meeting of the American Phytopathological So-

ciety held in Washington, D. C., during a discussion of the chestnut blight problem, the writer made the following predictions:

(1). That chestnut blight was not imported into the United States from Japan; not saying that it does not occur in the latter country.

(2). That it is a native American species.

(3). That it is a previously described species.

(4). That there is evident relationship between its rise and spread in this country and weather conditions.

(5). That it is impossible to eradicate it by the cutting out method.

(6). That there will in time be a decline in its prominence due to natural conditions.

(7). Unpublished—by which was meant that the fungus occurs in Europe.

I propose here to discuss some of these predictions, thus giving my reasons for presenting them. There have been advocated two almost diametrically opposed views concerning the chestnut blight in this country.

The first of these, if I understand it correctly, assumes that the chestnut blight is a recently introduced disease, apparently from Japan, and that its spread and destructiveness here have not been at all influenced by weather conditions; that if left uncontrolled, it will continue to spread and devastate our forests until they are practically ruined.

The second view, advanced by the writer, assumes that the chestnut blight is a native American fungus, apparently also indigenous to Europe, and that weather and other unfavorable conditions, which have weakened the vitality of the chestnut trees in the northeastern United States, have had much to do with its sudden, destructive, and wide-spread appearance, and that it will not necessarily wipe out all of our chestnuts, as it is likely to decline gradually with the disappearance of the factors that have favored its rise into prominence.

Between these two extremes there are those who take one or the other view in modified form, or agree in part with both. It is highly important that the truth of the matter be ascertained, since upon the nature of the fungus and the manner of its appear-

ance in this country depend in large measure the practicability or impracticability of the only method now advocated for its control, namely, the cutting out and destruction of the diseased trees.

Before proceeding to a discussion of the reasons why I hold the view I do, let us consider for a moment the apparent reasons for the other view. So far as I can make them out, they are as follows:

(1). The trouble appeared suddenly and seriously, and as it is unusual for a fungus thus to spring up in a country where it has never been known before, it is presumably an imported one.

(2). But such a serious disease of chestnuts has never been known before in any other country. However, insects and weeds and fungi also, that have been comparatively inconspicuous in their native countries, when introduced into a new country, sometimes develop into serious pests because of their new and unusually favorable surroundings.

(3). The Japanese species of chestnut has apparently shown considerable immunity to the chestnut disease, more so than any other. It may therefore be supposed that the fungus is an inconspicuous native of Japan, and was brought into this country on seedlings from there. It spread to our native chestnuts, and finding these much less resistant to its attacks, has suddenly spread through the regions in which it is now known to occur.

(4). The preceding statements being true, there is no reason why it should not go on spreading, and annihilating the chestnuts of the eastern and southern United States.

(5). Preliminary cutting out experiments in a region within thirty-five miles of Washington, D. C., are claimed to have prevented the spread of the disease in that region, and based on this, the much more extensive work in Pennsylvania is now being carried on, and similar work is advocated in other States to prevent its further spread through the south and west.

Now, if the preceding points are true, Pennsylvania has possibly taken a wise step in trying to control the disease. That it can ever be eradicated, the writer does not believe for one instant, and he has serious doubts about the control being effective or financially profitable, since it means a continuous fight, much

like the gypsy moth work in Massachusetts, to prevent re-infection. If the above points, however, are not true, it seems to me, at least, that the efforts for control planned for this State will be time, money and trees thrown away.

The author of the first view has not, to my knowledge, claimed that the chestnut blight was imported from Europe, or that the European chestnuts in this country are especially immune to the disease. If he should ever advocate that it is a European importation, I do not see how he can account for the fact that it has caused no very noticeable trouble on that continent, and yet, when introduced here, kills off the European chestnuts as readily as the native ones; unless he admits that weather or other conditions have been unfavorable for these chestnuts, and have thus favored the development of the fungus.

Proceeding now to my own theory, let me take it up point by point.

First, that the chestnut blight is a native of this country. In 1909 I sent to Professor Farlow, of Harvard University, the first specimen of *Diaporthe parasitica* that he had examined, and asked his opinion as to whether or not it was the same as a certain species that Schweinitz had years before described on chestnuts from this country. He replied that it was not, but that it agreed more perfectly with the genus Endothia than with Diaporthe, and that it was closely related to, but apparently distinct from, *Endothia gyrosa*. *Endothia gyrosa* was originally described from Carolina and Pennsylvania by Schweinitz as *Sphaeria radicalis* and *Sphaeria gyrosa*, and reported by him on Fagus and Juglans. It has since been reported in the United States on Liquidambar and Quercus species, chiefly on the latter.

With the clue furnished by Professor Farlow, I found and so stated in my 1908 report, that a specimen of *Endothia gyrosa* on chestnut collected by Scarrado in Italy had been issued in de Thuemen's Myc. Univ. No. 769, and that so far as its gross appearance and pycnidial stage (the only stage present in my specimen) were concerned, I could not distinguish it from *Diaporthe parasitica* Murr. As the ascospore stage was not present, I did not venture to claim that they were the same species.

The writer has since made a careful hunt for *Endothia gyrosa* and has specimens of it on two species of oak collected in Connecticut and the District of Columbia. Cultures have been made of these, and from *Diaporthe parasitica* on chestnut obtained from the same localities. Our studies of these cultures and specimens from various localities are not yet complete, but they have gone far enough to say definitely that *Diaporthe parasitica* belongs in the same genus with the *Endothia gyrosa* on oak, and at least is very closely related to it, though at present my opinion is that they are distinct species. Professor Farlow has also made further studies, and I have presented his paper on the subject.

We have not been able so far to find in literature a reference to *Endothia gyrosa* on chestnut in this country before the outbreak of *Diaporthe parasitica* in 1904. Neither have we found specimens in an herbarium that were collected before that date. We have not, however, quite exhausted all opportunities for investigation along this line. If it is ever proved that our *Endothia gyrosa* on the oak is exactly the same as *Diaporthe parasitica* on the chestnut, of course it is at once apparent that *Diaporthe parasitica* is a native and not an imported fungus.

A second observation that leads me to believe that *Diaporthe parasititca* is a native species is the fact that frequently in Connecticut I have found it as a languishing parasite on the roots and base of trees, where it was doing no very apparent harm, and this is somewhat the way *Endothia gyrosa* occurs on oak here and elsewhere, and is also the way that the so-called *Endothia gyrosa* on chestnut acts in Europe, where it causes no particular trouble. This makes me believe that these particular occurrences of *Diaporthe parasitica* in Connecticut represent the fungus in its native condition as an inconspicuous parasite, rather than as an introduced pest that is bound to kill those particular trees. Likewise, I believe that at least part of the so-called spread of the disease in this country is merely an unusual development of the fungus which has existed there for years in an inconspicuous way.

A third indication that the chestnut blight is a native species is a comparison of the situation of *Endothia gyrosa* in Europe and in this country. In Europe *Endothia gyrosa* has been re-

ported on chestnut, oak and various other hosts in different places, but apparently the natural home of the fungus is Southern Europe, as it has been reported most frequently from Italy and France. In Germany, Winter reported that it produced its pycnidial, but not its perfect stage, though both are found in Italy. Now, if *Endothia gyrosa* has a variety of hosts, including chestnut, in Europe, and prefers a southern habitat, what of its preferences in this country? From an examination of literature and of specimens in the New York Botanical Gardens, it is apparent that *Endothia gyrosa* has been reported much more frequently south of Pennsylvania than north of it. For two years, I and others have been looking for it in Connecticut, and only this winter was it found by our forester. This specimen, like those reported by Winter from Germany, has only its pycnidial stage, though this is the time of year to find the asco-stage. *Endothia gyrosa* has been found on as many hosts in this country as in Europe, and likewise chiefly from the south. Why may we not then expect to find it there on the chestnut? We certainly have had trouble enough with the chestnuts in the South in former years to believe that it might occur there.*

The second point expressed in my view is that the chestnut blight fungus is also a native of Europe. Briefly stated, my reasons for this belief are: (1) The specimens in deThueman's exsiccati on chestnut in Italy already referred to; (2) the statement of Professor Farlow that he has seen identical herbarium specimens of it from Europe; and (3) a recent letter from Professor Saccardo of Italy, who states that he and Professor Hohnel simultaneously recognized that *Diaporthe parasitica* Murr. is the same thing as *Endothia gyrosa*, both in its ascospore and conidial stages. A critical study of more specimens on all hosts from each country may, however, settle differently some points at present not clear to me.

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*After the Harrisburg conference the writer went South especially to see if *Endothia gyrosa* or *Diaporthe parasitica* occurred there on chestnut, as suggested in this paper, though never having been so reported. Stops were made at Roanoke and Blacksburg, Va., Bristol, Va., and in Tennessee and at Asheville and Tryon, North Carolina, and Lynchburg, Va., and at each place there was found the suspected fungus on both chestnut and oak, and more frequently on the former. This fungus occurred as a languishing parasite or as a saprophyte, usually at the base or on the roots of the trees, and was never found forming isolated cankers on the otherwise sound sprouts, as is *Diaporthe parasitica* in the North. Apparently this fungus is the same on both the oak and chestnut, and the same thing as the so-called *Endothia gyrosa* on the same hosts in Europe. What its exact relationship is to *Diaporthe parasitica* has not yet been fully determined. In gross appearance its fruiting pustules are scarcely different, except possibly slightly less luxuriant, as a rule. Its pycnidial spores or Cytospora stage is apparently identical with that of *D. parasitica*, but the asco-spores are evidently as a whole less luxuriant; that is, they are somewhat smaller, and especially slightly narrower. Whether these differences are those of a strain, variety, or distinct species, is yet to be determined by cultures, inoculations, and further study.

The third point in my theory is that weather and other unfavorable conditions have weakened the vitality of the chestnut in the eastern United States, and that the fungus has developed into prominence because of this. The reasons I have for advocating this theory are as follows:

(1). The chestnut blight came into prominence suddenly in 1904, just after the severe winter of 1903-4. From my own observation at that time and since, I know that this winter was unusually severe on fruit, and to a less extent on shade and forest trees in Connecticut. I am corroborated in my views by the observations of Professor Stone, botanist of the Massachusetts Experiment Station, who has made a specialty of the diseases and injuries of shade and forest trees. Various experiment stations and other publications show that the fruit trees in New York, Michigan and Ohio suffered from this, and possibly from subsequent cold winters.

(2). Since 1907, speaking particularly for Connecticut, we have had five summers with unusual periods of drought, culminating with that of last season, which lasted from June until about the first of August. I know that these droughts have been hard on forest and shade trees from their weakened condition and from the unusual number that have died. Except in the case of chestnuts, the death of these trees has been laid directly to the drought, by many observers. I have given somewhat more detailed accounts of these weather conditions in my previous reports, and will not dwell further on them here. We have found that chestnut trees on the south and southwest exposures, (and on that side of the trees) where they have suffered most from drought and winter injury, have sometimes developed severe outbreaks of the blight, while the trees on the more protected northern exposures in the same vicinity did not.

(3). We have found cases of chestnut blight developing more severely in woods suffering from fire injury than in surrounding woods not so injured. It has been our almost universal experience that blight develops first and most severely in the easily injured chestnut sprouts from one to ten years old, whose new roots have not yet become thoroughly established, and last on the

sturdy old seedling trees. How many times we can renew our chestnut woods by sprout growth is a question, but that such trees in time are weakened foresters generally acknowledge. Most of our Connecticut chestnut timber has already been cut over at least two or three times.

(4). The unusual spread of the disease in very dry years is contrary to the general experience of fungous troubles, which are favored by moist years; and yet here is a case where the severer the drought, the worse the fungus became. If I am wrong about its relation to weather conditions, what a deluge of trouble we may expect with the return of a few moist years!

As to my statement that chestnut blight cannot be eradicated in this country by the cutting out and burning method perhaps no one now thoroughly conversant with the trouble will deny, though there are those that evidently believe it can be controlled in this way. Man never yet has eradicated a fungus so widely distributed as this, unaided by nature, and is never likely to unless he eliminates the host. Professors Stewart and Murrill have given reasons why they believe it is impractical even to try to control the disease. I agree in the main with their contentions. The method that is advocated in the present case aims at the complete destruction of the infected trees and in some regions, if I am informed correctly, of the healthy as well. This is a decidedly unusual procedure in the control of plant diseases, since usually we aim to save not only the healthy plants but the infected ones as well. I know of no similar practice, outside of nursery inspections, except that applied in a few regions for the control of peach yellows. There the infected trees only are destroyed, but the yellows would kill those any way in a short time. There is, however, no National effort to control peach yellows even in this way and at least one State, Connecticut, that started under authority of law to inspect orchards and to destroy all infected trees, repealed that law after a few years' trial.

Now as to my last contention: that the disease of itself will gradually decline with the return of a series of years favorable to the chestnut trees. If unfavorable weather conditions for the trees have been the chief cause of the rise of the fungus as an aggressive parasite, favorable weather conditions for the chest-

nut will of course bring about the decline of the fungus, unless it has already attained an unusual and lasting virulence from its present aggressiveness.

That chestnuts have in the past in our southern States suffered from disease or injury of some kind yet unaccounted for, no one who has looked up the literature of the subject can deny. I have gathered together statements of this sort from various sources, but will not take the time to present them here. From the fact that no trained mycologist has studied these outbreaks in the past, and from the further fact that the observers often speak of them by such terms as "blight," "root rot" and so forth, and did not find insects responsible, I, for one, am open to proof as to their relation to *Diaporthe pasasitica,* despite the statement of two or three observers who have recently examined trees in the South, that there is no such relationship. Anyway, the chestnuts have suffered severely in these States at different times during the past seventy-five years, and have been apparently crowded out of the lower lands, but they still seem to be quite vigorous and abundant in the higher regions of those States, since the chief object of the campaign in fighting *Diaporthe parasitica* seems to be to keep it north of the Potomac River in order to preserve the valuable timber said to exist south of it.

THE CHAIRMAN: We are now to be favored by hearing an illustrated lecture on Chestnut Culture, the speaker being Professor Nelson F. Davis, of Bucknell University, Lewisburg, Pa.

CHESTNUT CULTURE.

AN ILLUSTRATED LECTURE BY PROFESSOR NELSON F. DAVIS, OF BUCKNELL UNIVERSITY, LEWISBURG, PA.

Mr. Chairman, Ladies and Gentlemen: I wish to take you to-night on a little trip to Irish Valley, situated near Shamokin, Pa. I will take you on this trip by a series of lantern slides. I wish to show you to-night what has been done in spite of ene-

mies, by Mr. C. K. Sober, who has been working with the Paragon chestnut since 1896 and 1897. In 1896 Mr. Sober began to graft the Sober Paragon chestnut, as it is now called, on native chestnut sprouts. He had on his farm in Irish Valley about four hundred acres of waste mountain land. This mountain land he wished to reclaim. It was not suitable for ordinary farm crops. His method was to remove everything and, by means of cleanliness, which he obtained by using the grubbing hoe, the saw, the axe, and the pruning knife, and then burning everything, to keep his growth clean. In this way he hoped to keep out the enemies, such as the weevil, and another worse than the weevil, the burr worm. There are two species of the burr worm, one of which is new to scientists. It belong to the genus *Holcocera*, and has been named. in honor of Mr. Sober, *Holcocera Soberii*. The other larva, the adult of which is not known, is equally injurious. By means of removing the nuts as soon as they emerge, removing the burrs from the grove and burning the shucks as soon as the nuts are taken out, Mr. Sober on fifty acres has practically removed the weevil and burr worm, so that last year the nuts gathered from fifty acres contained scarcely a peck of wormy chestnuts. He has done this by means of cleanliness in every way, and by removing the larvae and not allowing them to mature. In other parts of the grove it has not been possible to do this in every respect, and there the weevil is an enemy. It has been his custom, during the last ten years, to remove every dead limb that has appeared in the four hundred acres and if there was chestnut blight, it has been cut off and burned. An actual count of the chestnut trees now in the grove showed forty-four thousand and thirty-five trees that are bearing, and in addition to those there are others that are not yet matured.

By means of these slides I will take you in harvest time over the grove as it now is, and then, by means of other slides which I have taken during the last ten years, show you the various steps that have been taken in developing this grove. If we may have the lantern, we will begin our trip.

The first slide is a portrait of Mr. C. K. Sober. (Applause).

The next slide represents a portion of a fifty-acre tract, as it appeared when he took possession of it. It was covered with waste wood of various sorts. Very little of this was of any use.

A typical cluster of burrs of the Paragon chestnut.

Distant view of part of 300 acre plot of Paragon chestnut grove, near Paximos, Pennsylvania.

Some could be used, of course, for pulp wood; but notice, among the old stumps, there are a few sprouts coming up. These are sprouts of the native chestnut, and it was upon these sprouts that Mr. Sober conceived the idea of grafting. Of course, it had been done elsewhere, but not upon his four hundred acres. That was the beginning of his Paragon chestnut.

As we approach the grove at the present time, you will see the mountain side in Irish Valley from this view. This shows on the hillside from a distance a portion of the four hundred acres, which is now grafted, and from one end of the picture to the other represents a distance of over a mile.

In the next view, as we approach the farm, coming near to the buildings, you can see the nature of the surrounding country, the hillside. Back in the centre of the picture, at the top, is ninety acres now grafted to the Paragon chestnut.

In the next view we see the farm buildings and, starting from the buildings, we will now visit the grove as it appeared last October.

Driving up the road you notice along the roadside everywhere seedlings grafted to the Paragon. They have been transplanted, and all along the road wherever you drive, you will see these trees.

As we approach the grove, you can see its condition in this view. This is a portion of the four hundred acres. There are shown in the view about three hundred acres. Above you see the the mountain side, as this grove would now have been had he not cleared it.

A nearer approach to the grove shows the grafted trees, and above them the native chestnut principally. This land was originally covered with, I suppose, white pine. That was removed and later hard woods came in its place, oak, chestnut, and other hard woods. Now it meant considerable work removing and clearing and grafting these trees, and I wish to show you the various stages as we pass along.

As we enter the grove, it is harvest time, as shown in this view. They are gathering the nuts, which have been placed in bags at this particular portion, so that we are just entering the grove.

In the next view, the largest tree at the right is about nine years old. Really the work from 1896 until 1900 consisted in experimenting. When the methods were perfected, the real work began, in 1900.

Another portion of the grove shows a tree on which the nuts are maturing. This tree is about eight years old.

A branch from that tree shows the nuts almost ripe, just ready to open. If we examine under the trees, many of the burrs are fallen to the ground. You can see the burrs and the nuts in the burrs. It is harvest time and the harvesters are gathering the nuts and placing them in piles, whence they can be hauled to the threshing machine, which will be shown later.

The next view shows a normal burr, containing three nuts.

I will now show the different stages through which fifty acres of this four hundred have passed. I do not have the photographs taken in 1896 and 97. The photographs I have were taken beginning with 1903 up to the present time. This view shows the work of removing the brush piles, which were left on the ground. These had to be burned, the logs removed and all the sprouts protected. Every native sprout was protected in every way from fire and from injury, and in the front of this view you see a number of sprouts that have been left. These are ready to be grafted. When the logs are hauled out, these have to be protected; when fires are made, to burn the brush and rubbish, these need to be protected. A sawmill was set up, and what wood was valuable used either for railroad ties, or mine props, or pulpwood, for whatever it could be used, so that it partly paid for clearing.

When the sprouts are ready to graft, they are about six feet high. Four sprouts are here shown. The two on this side were cut off about the point where the hand is, and these two were selected because, coming from the stump, they came from lower down and a little farther out and apparently had better roots. So two were selected and two were left. The two were grafted on this side and two left, in case of injury to the other two; so that, if anything happened, the others could be grafted the next season.

Old trees were cut down in different parts of the farm. This shows a giant tree that was cut in order that this little sprout at

the side might be grafted. This was about two years after the tree was cut.

This shows another tree from which four sprouts were grafted. This was grafted in May, and in June the sprouts were started. Of course, all buds below the graft were removed in order to prevent the strength passing into the buds.

This view shows the same grafts as they were maturing during the first summer. Three have started; the fourth was a little slow in starting.

Here they are shown after one season's growth. The roots from the old stump contained lots of nourishment and pushed the growth rapidly, so that during one season the growth that you see took place. This was taken in October.

Another view showing one season's growth, after the leaves had been removed. This shows four sprouts grafted. They are growing together.

This is a typical sprout after the first year's growth. Notice it makes a fan-shaped tree. At this point, sometime during the early spring this limb would be cut off here (indicating), this one and the one at that point, thereby insuring the next year a low crown. The growth is so rapid that frequently the wind would break them off if they were not cut back, so that it is much better to cut them back.

The next view shows a grafting outfit. These are the sprouts cut from the Paragon trees, called the "scions," to be grafted on the native sprouts. This shows the tape, which is waxed, and some of the grafting wax. This is the machine for winding the waxed tape, previous to the beginning of the grafting.

The wedge graft was used first. This view shows the method of insertion of the wedge graft. It is then waxed and wound with the waxed tape. The wedge graft was used by professional grafters who were employed in 1897, 1898 and 1899, but only about two per cent. survived. The season is very short during which this could be used, because the bark separates from the stock so early that the union would not take place.

This view shows one of the trees, showing a successful union of the wedge graft. This is one of the oldest trees now to be seen in the grove.

This view shows a wedge graft, one of the original ones, that did grow. This photograph, I think, was taken in 1903, but only about two per cent. of the grafts in 1897, 98, and 99 lived, so that there are only a few of these surviving. The wedge graft method was consequently abandoned.

Then budding was tried. This method you are familiar with. This is the bud to be inserted. It is then inserted, wrapped with wax and covered with the cloth. This method, however, was not successful when used in the grove. A few of them lived. The next view shows such a case; two on either side are buds that did live, and in the centre is a whip graft. Here is one that was successful. After a time the tree heals up perfectly at the union.

This view shows the manner of inserting the knife in the whip graft. It should be inserted at a considerable depth. This one is shown with the top cut off ready for grafting. This is the sprout, on which the graft is to be set.

This shows another view of the whip graft, the method that has been successful. This came in 1900, when Mr. Sober personally took charge of the grafting. He instructed green men rather than professional grafters and had them use his method, being particular to make the scion fit perfectly to the stock. It is then inserted and driven down so that the tongue holds it at that point; it is cut back a little later, waxed there (indicating) and the bud is allowed to develop.

This view shows the completion of it. The stock may be even a little larger than the scion. It is better to have them the same diameter. It is then waxed and wrapped with tape and a little piece of wax put on the top of the scion to keep the moisture in. This is the most successful method with chestnuts.

This shows one after the graft has started. This is waxed muslin, which is old muslin that will tear readily as the tree grows, and will remove itself, so that it does not girdle the tree.

This is after one year's growth, the union practically complete all the way around.

The next view shows a through section, showing the complete union. Here is the tongue which held them together; and here is another section through. Occasionally they decay at that point. This shows a perfect union of the whip graft.

It is very necessary to keep the buds removed from below the graft. The four grafts shown in this view started, all of them, but the buds below took all the strength from them. The bark has been removed from the three on this side; from the other it has not. The sap, of course, flows along the line of least resistance and takes all the strength and the graft dies.

The next is a photograph to show the Paragon grafted on oak. The tree is still living. The oak now is smaller in diameter than the chestnut, the chestnut growing faster. This was not very successful; still, it is successful to the extent that it lives and bears nuts.

A defective union. At that point (indicating) enemies can enter,—fungi and beetles. The wind also will frequently break off a tree at the point of union, if the union is not perfect. A sprout was allowed to mature on this and later was grafted. The growth is very rapid, and the chestnut not being a strong wood, many were lost in this way where the union was defective.

This is a portion of the fifty acres as it appeared six years ago.

Here we have a view of it a little later. All the roots of the other trees begin to sprout and it is necessary to clean out everything. If the underbrush is allowed to grow, it will, sooner or later, choke out the trees and will allow enemies to develop; you cannot keep it too clean. Fires will run through it; so Mr. Sober early found that it was necessary to keep the growth clean. Many parts of it are now clean enough to mow with a lawn mower. In many places the grass is beginning to grow. I wish you would notice how clean the grove is in places. This is the condition soon after the grafting. Then it was necessary to employ from twenty-five to fifty men to clean out and, in order to save the young grafted trees, screens were made. At one time I saw as many as twenty-five of these screens. They were covered with asbestos to protect them from the fire, and the young sprouts that have been grafted are back of the screens. These men are grubbing out and cleaning, trying to get the ground clean enough to raise grass.

This view shows one of the screens a little nearer and some of the men, who rested a moment while I took the photograph.

Here they are again. Even after the trees are of this size, it is necessary to finish the cleaning. They are cleaning out everything; any suspicious sign, any dead tree, is cut out.

Another view showing them carrying the material to the screens for burning,—grubbing out sprouts, so that later it was possible to run a specially constructed mowing machine through it, and much of the undergrowth could be cut off in that way. It is possible to run a mowing machine through nearly all of the four hundred acres, except where there are too many stones.

Originally the idea occurred to Mr. Sober to graft the tops of a few of the trees, and we had full sized trees in which eight or ten grafts were set on the top. This view shows one where the top was grafted; this one is another, with the top grafted. That, however, did not prove successful, because you would have only a few limbs in the top, and in a little while the others would catch up with them.

Here is another view of a tree grafted at the top, and this a younger tree, two years old, beginning to bear nearly as many nuts as the grafts at the top of the other tree. You can see, therefore, why that method was abandoned. The Paragon begins to bear very early, the second year after grafting; occasionally the first year a burr or two will mature.

Now the grove is beginning to look cleaner. These trees are two or three years old. This was taken in the summer time, in June, before the trees had blossomed. This is a young tree two years from the time the graft was set, really the third summer for it; a typical tree. It is now making independent roots for itself and in a little while it will be free from the old stump. Many of the old stumps are still standing. Some of them have rotted away.

Another portion of the grove, just a little later, showing trees one, two, and three years old, and the tops of a few trees that were grafted in the top.

This view shows two trees by the roadside, one two years old; the other in the third season of its growth. Notice the shape. They were cut low, so as to secure this low crown, which makes it convenient in harvesting the nuts. It keeps the trees low. It is like it is with a peach tree; the shape is much the same as that of a peach tree.

Group of Paragon chestnut trees, two, four and six years old.

This is a view of an ideal tree, three years old, with a low crown, two feet from the ground.

In this view, the huckleberries are beginning to grow underneath; all through the grove the huckleberries have filled practically everything. The ground has been burned over, to burn up the leaves and the burrs, which contain the enemies, and the huckleberries and chestnut sprouts are coming up; but it is necessary to keep these down.

This view shows how that same ground was cleared, and how it appeared in the winter time. Everything that could be removed was grubbed off and burned, the screens which you saw before being used.

This is a young tree, three years old, in the third summer. From that tree three hundred burrs were removed. Two hundred were left to mature. This was too many, and many of them dropped off. The leaves were picked from that same tree, and this view shows it with over a hundred burrs in which the nuts are practically ripe.

This is the grove as it appeared in 1904. This is a portion not of the fifty acres, but a portion in the flat which was grafted about 1900, some of it in 1899. Notice now that the grass is beginning to grow below the trees. The stumps are there, but the tree is becoming independent. It is now possible to have the mowing done by means of cattle and sheep in the grove.

This is another view showing trees out by the edges, as the sprouts come up. They were grafted until there is a stand all over the four hundred acres, and now it is necessary to use the axe to trim out, because they are too thick.

Another portion, showing a four-year old tree, with nuts.

This view shows the trees a little older. This was taken in 1910 and shows the character of the mountain side. It is covered with stones; impossible to mow around it; it has to be grubbed,—but an ideal place. The stones help to keep the moisture in the ground and the trees do exceptionally well.

This is another tree, a photograph taken in 1911. It was in October and the nuts were ripening on the tree.

The next view shows part of an old hedgerow that had grown up with everything. Stones from the field on either side of this had been thrown along a gully that existed there at one

time. In that row, in which there are altogether about twenty-nine trees, three years ago there matured nine and a half bushels of nuts, just on that old hedgerow, that could not be used for anything else, and full of stones. Some of the trees in that row last fall had almost half a bushel of nuts on single trees. The trees on the four hundred acres last year were practically all bearing; some of them less than a pint to the tree; others almost half a bushel to the tree.

This view was taken in 1903, or 1904. Notice the size of the trees, especially. About five hundred sheep were put into the grove and they are doing the mowing and fattening themselves, where the machine is no longer needed.

This view shows the same trees in 1911. The fence by the side shows the growth from 1904 to 1911. They are rapid growers, because they have a good root system.

This is a view of the ridge, a portion of the ridge that has a southern front. There are ninety acres grafted, and all bearing. The red spider appeared on this southern side, the sunny slope, and interfered with the growth.

Here is a near view on the three hundred acre lot. It shows the condition which might have existed up to the top of the ridge. That is Mr. Sober's line. A fence is built,—you can just see the posts,—and that fence is a mile long, running from one end to the other, and below it is what you see and above is waste mountain land, containing chestnut and rock oak. Through that, of course, fires run every now and then and it is necessary to establish fire lanes at the upper end, so that below the fence is a fire lane which will prevent a fire from getting into the grove.

This photograph shows what was there in 1896 and 1897—that same grove that you saw up at the edge. This has been possible with Mr. Sober, and it is possible anywhere where the chestnut grows. You can make the change from this to what you saw before.

This is the identical spot that you were looking at in the picture preceding. The preceding picture was taken five years ago, and here it is to-day. These trees have been grafted two years and three years, and they are bearing. On this fifty acres ever since they have been bearing, every nut, practically, has

Harvesting and threshing Paragon chestnuts.

been removed, so that last year on this fifty acres there was scarcely a weevil, and scarcely a burr worm, in the nuts that matured there.

Another portion, showing young trees bending over, breaking down, almost, on that same fifty acres. It was taken in 1911, about the first of October. The trees are heavily laden, the nuts perfect.

Another view showing the sheep doing the mowing. The cattle help with the work. Pigs help, but I do not have a photograph showing them. A lot of them were put in after the crops were gathered. The men harvested the nuts and afterwards the pigs were turned in and found enough to fatten themselves. I think that on the waste mountain land in this State, you could fatten on chestnuts all the pigs that we raise, if we used it for nothing else.

In harvesting, the nuts gathered in 1911 were hauled to a threshing machine. It was necessary to have a machine made, the problem of threshing the nuts, getting them out of the burrs, becoming so great. This shows a photograph of the men hauling the burrs before they are quite ripe, and placing them in piles. They ripen, the burrs open, and the nuts can then be picked out.

This shows another pile of the burrs. Notice that they are opening. This was taken a little later and the nuts were maturing.

Harvesting before we had the machine. The men had to pick them out. The nuts were taken out and placed in sacks, all by hand. This shows a pile of burrs. Every burr had to be opened with gloves, and it was very tedious. The problem was too great, so that a threshing machine was invented by Mr. C. K. Sober especially for the purpose this last year, and this view shows the machine in operation. The nuts were hauled in piles in the burrs. They were then put through this machine, which is run by a little gasoline engine; the nuts ran out into a basket, were put into sacks, and later they were loaded and carted to the house to be assorted.

This is the assorting room. They are then packed in boxes. Here are crates filled with nuts. Last year a carload was sent to Seattle, Washington. After the season was over, orders were taken for two carloads to be delivered at Seattle next fall, and

the same man may take the entire crop next year. What that will be I cannot say. This year it was between three and four thousand bushels, including good and bad nuts.

In this view typical burrs are shown. Notice how thin the husks are on many of them.

Another burr. It does not look as if it could cover the nuts. In fact, it could not now, because the burr has shrunken away as it dried out, leaving the nuts. Four, five and often seven nuts are found in a burr.

This view shows seven in a burr. Notice that they are crowded in, which gives them irregular shapes.

In this view the nuts in the lower row are covering silver half dollars. The seven below measured over ten inches. Eight of them measured thirteen inches.

In this view the nut in the lower right hand corner is covering a silver dollar; the other four covering silver half dollars. Above, are typical burrs.

Here are thirty-two selected nuts, measuring one quart. Another group of the burrs as they were taken from one tree, a little seedling three years old.

Forest fires were started in the mountains above by hunters, carelessly or otherwise. They run down into the grove, so that it is necessary to watch cautiously. Perhaps, however, the burning of the part above helped to destroy some of the weevils and some of the burr worms; but of course the danger is that it will get into the grove, and it did burn over nearly ten acres at one time. This view shows a fire lane; the building of a fire lane, between a grove and the woods above. It shows what the grove would have been had it not been cultivated and put to this use. That is the land immediately above it, full of chestnut timber.

This shows another point, showing on one side where the fire just went through. It did not get into the grove. The trees are dead, not from the blight in that case, but from the fire. It shows on the other side chestnut grafted to Paragon, and the four hundred acres is practically surrounded on three sides by that same kind of timber.

There are other enemies. Meadow mice girdle the young sprouts at times. The sprout shown in this view was girdled

Threshing Paragon chestnuts, Fall of 1911. (Machine designed by Mr. C. K. Sober).

by a meadow mouse. By keeping them clean, however, cutting the grass away and burning it over, the meadow mice are kept down with the other enemies.

The seventeen year locust is another enemy. There is a brood of them every three of four years, it seems. In 1903, 1906 and 1910 thousands of them,—millions, I suppose,—came out. This is one view, which I took looking up, pointing the camera into the tree. These are the empty skins of the chrysalides as they came out of the ground into the tree, the cicadas having crawled out.

This view shows a little wild indigo plant, on which there were two hundred and fifty cicadas. The injury comes when they deposit their eggs.

The next view shows two branches recently stung by the cicada. The eggs are deposited, making holes through which fungi may enter. The wind blows then and breaks them off at places, and the branches fall to the ground; but the cicada has left holes and it is necessary to trim off the branches and prune. This view shows a little tree that has been pruned. The dead branches are below and of course there is not much left. This interferes with the bearing of that tree. A tree trimmed in 1910, in 1911 had no bearing wood on it; a loss of the nuts, loss of a year's crop, because of the cicada. However, if the limbs are not broken, they begin to heal.

You can see in this view where the ovipositor punctured the wood. This was stung in 1906 and the photograph was taken in 1910. They are slow in healing up, and form wounds through which the spores of the fungi may enter.

This view shows still further the process of healing. Some of them heal up entirely and apparently suffer nothing from the injury.

This tree was stripped by the striped oak worm. There are other enemies. Mr. Sober and I have been fighting enemies for ten years. Nearly every one discouraged Mr. Sober. He stood alone; but he is fighting them, and will continue to fight them. In spite of the blight and in spite of everything, he expects to see chestnut trees as long as he lives, and if we could come back in two hundred years, I think we would find chestnut trees there.

One of the enemies that is most serious is the burr worm. At

the time the chestnut blossoms, a little moth lays an egg on the young fruit. The egg hatches and a little worm burrows its way into the burr. It seems to prefer living on the burr rather than the nut. This view shows what I have called the "little" burr worm. Here it is. It lives normally in the burr. Occasionally it eats into the nut, but it does not like the nut, but leaves an ugly hole and the nut afterwards frequently moulds.

This shows the adult moth, the *Holcocera Soberii.* It is very similar to the *Holcocera glandulata*, but, according to Kearfoot, of Montclair, New Jersey, it should be called a distinct species, and it has been named in honor of Mr. Sober. This is one of the worst enemies. There are two shown in this view, a "little" and a "large" one. This is the larger one. (Indicating). I have tried a number of times to get the adult of that, but I have failed thus far. It is easy to get them in the larval stage, —you get lots of larvae,—and they will make the cocoons. Normally the cocoon is made in the burr and fortunately when the burr is removed the cocoon is removed; but I have not been able to get them to mature. I do not know the adult of this one.

This view shows the hole it makes into the nut. It is cut away to show it. It has not gone in very far and this has removed all the injury done. The other one is the injured one, showing the spot, in the edge of the screen. This one is injured here. (Indicating). If the nuts are eaten immediately or used, they are scarcely injured; but if they are allowed to stand for a time spores of various moulds get into them and the nuts soon rot entirely. In this case this nut shown has cracked open, and is full of black spores. I am not able to identify all the moulds; some of them resemble very much the ordinary bread mould.

Insect traps were made by Mr. Sober in 1910 and placed throughout the grove, and thousands of moths, many of them belonging to the same genus, the *Holcocera*, were caught in these traps. Lanterns were suspended from the trees beneath which were these tin arrangements, and below was a pan of water on which was placed a little oil. That arrangement caught thousands of moths. That is one method of controlling the enemy.

The grove is full of birds. There are many blue birds, and nest boxes have been put up. I do not know whether it is a good

Insect traps in chestnut grove. Largest trees are twelve years old.

plan to encourage the birds or not. The woodpeckers are there, feeding on insects and the beetle larvae under the bark. It may be a good chance to spread the chestnut blight, but they help to control the moths. They feed on hundreds of them. You see them hunting everywhere. The insect-loving birds are there. You find the vireos, the red-eyed vireo especially; you find the American redstart; you find warblers. They are there looking for the moths and weevils. Chickens were placed in the grove. They search for grubs and everything they can find and, of course, in doing that they destroy many of the chestnut weevils and the grubs of other worms.

This view shows the chestnut weevil, the *Belaninus,* on the burr. These can be controlled by removing the burrs immediately, before they have time to come out on the nut.

This view shows them at work. Several females were placed on this burr, which I have cut in two.

This view shows the long, beaklike proboscis. There is another one, and another in the corner. There was another one here, but it crawled around too much to be photographed. How the eggs are deposited, I cannot say, but in some way, I think through that long beak. They have two slim feelers, with which they can take the eggs from the ovipositor to the end of the beak. This view shows a big one. The weevil, as you can see in the next photograph, never withdrew its beak. There it is, in the picture. This was removed and in its place larvae developed. I have taken out of one nut as many as fifty-five grubs of the *Belanius.*

This view shows them maturing. In this one there were as many as thirty larvae.

This view shows them in different stages; they are practically mature. When they are mature, they come out through the little hole in the nut and burrow in the ground. They remain there until June or July, when they transform into pupae. The next view shows six of them taken in July. In about two weeks they mature. The next view shows six adults, three male and three female. I think in some way the eggs are taken by means of these appendages which will reach the end of the bill and

reach the ovipositor. I have never been able to see them do it, but in some way I think the eggs must be inserted by this method.

The demand for the Paragon nut has come from all over the United States, and it was necessary to start a nursery. Mr. Sober, with the cleanliness he practices, will keep this going in spite of the blight. He put away last fall three hundred bushels of nuts, burying them, and now a little later they will begin to sprout. When they are sprouted, in beds of sand, they are taken out and planted. The method is before the nuts are planted, to pinch the large tap roots off at this point, so that a fibrous root is started. Otherwise this (indicating) is what you get, and it is hard to transplant that tree and have it live. To pinch off that root, or to put it in horizontal position, will develop fibrous roots. This one was not pinched off, but was planted with the tap root in a horizontal position, and you see the result. This nut (another view) was planted and allowed to develop for itself; and you see the difference between the two.

The nuts are planted in rows, and here you see them after the first summer's growth in the nursery.

Here they are, two years old, ready to be grafted. Some of the seedlings bear the second year and third year, but they are not true Paragon. Some of them may be better. Last year fifty seedlings, two and three years old, had nuts on them.

This view shows men engaged in grafting these seedlings with the Paragon. This gives an idea of the size of one nursery.

This view shows one season's growth after grafting on the seedling. You see it is nearly five feet high,—one season of growth, grafted on a seedling two years old. It is then trimmed back, of course.

There is one grafted one year, bearing a nut at that point and two nuts at that point, and still others here. They are grafted.

Large trees can be transplanted, but not successfully. It is very hard to get a tree that is five or six years old to stand transplanting. It does not pay to transplant the larger trees. Occasionally they will live, but the others soon grow and catch up with them.

Seedlings from Paragon nuts—to be grafted with Sober Paragon chestnuts.

Paragon chestnut trees, 9 years after grafting on native sprouts.

Now we will go to the barn and get our horse and go back to the station at Paxinos. Good night. (Applause).

DR. MICKLEBOROUGH: Will you permit a question?

THE CHAIRMAN: We will.

DR. MICKLEBOROUGH: I would like to ask the Professor if the blight has appeared in the Irish Valley?

THE CHAIRMAN: If you do not mind withholding that question for just a minute, I want to make an announcement, and then we are going to throw the doors open to discussion. At the afternoon session you directed the Chairman to appoint a Committee on Resolutions, this committee to include the Chairman of the Conference. The Chairman requested that persons attending the Conference should offer suggestions as to who should be included on this committee. He did not receive as many suggestions as he would like to have had, but he did receive a good many, and every person who was suggested has been appointed.

The committee as made up, is as follows:

Ex-officio, Raymond A. Pearson, Chairman of the Conference.

Maine, ...Charles E. Lewis.
New Hampshire, ...Philip W. Ayres.
Massachusetts, ...F. W. Rane.
Rhode Island, ...Jesse B. Mowry.
Connecticut, ...George P. Clinton.
New York, ...G. G. Atwood,
H. P. Marshall,
George L. Barrus.
New Jersey, ...Melville T. Cook.
Pennsylvania, ...I. C. Williams,
Harold Peirce,
W. T. Creasy,
Henry S. Drinker.
Delaware, ...Wesley Webb.
Maryland, ...J. B. S. Norton,
William McCulloh Brown.
Virginia, ...George A. Kerr,
George B. Keezell.

West Virginia, ...N. J. Giddings.
Ohio, ...A. D. Selby.
H. H. Bechtel.
North Carolina, ...H. R. Fulton.
Tennessee, ...J. W. Fisher.
Canada, ...Dr. H. T. Gussow.

In a very rough way, it has been endeavored to have the number of members from the States indicate something as to the number of persons who accepted invitations to attend this Conference. The Chair will suggest that the members of the committee meet in the seats at the right of the Chair immediately after adjournment this evening, for the purpose of organizing. Now, according to the program, we are to have a general discussion. The presiding officer almost feels that he should offer you an apology, because he is not personally acquainted with all the persons who may wish to speak. He appreciates that there are some illustrious persons in the audience and that he ought to know them; but, as he does not know everyone, he will ask again that each person, on rising, whether known to the Chair or not, will first announce his name and the name of his State clearly.

The papers that we have heard are all before you for discussion. It is your meeting. The Chairman is your servant, and if you desire to have the course of procedure changed in any way at any time, it is your duty so to state. We will now hear the first question.

DR. MICKLEBOROUGH, of Brooklyn: My question was, Mr. Chairman, whether the *Diaporthe parasitica* had appeared in the Irish Valley.

PROFESSOR DAVIS: Yes; it has appeared there, but in that grove for the last ten years every sign of anything suspicious has been cut out, and the nursery inspector who went through the grounds found forty-four thousand and thirty-five trees that are free from it. If there were some signs that were suspicious, these trees were cut. If it is there now, it is practically under control, and it is very, very hard to find it. We are not certain always that it is there. There is one disease that follows up a

fire that so closely resembles it that it is hard to tell it. It is sometimes doubtful. I have not, however, found any ascospores there this fall. The nursery stock shows nothing at all. The idea is to keep it clean, cut out everything, so we do not wait to see whether it is there or not.

DR. J. RUSSELL SMITH, of Pennsylvania: Mr. Chairman: before the cutters-out and anti-cutters-out begin taking up the questions of the afternoon, I want to speak about one point in connection with the recent lecture. Mr. Davis stated, in passing, that the waste land of this State would feed as many pigs as the whole State produces. We have lots of pigs, yet that assertion as to the possibilities of the waste land is understated.

Man, in looking at the botanical realm, began at the wrong end. When the human race looked at the hundred thousand species of plants, it picked out little measley grasses, with a grain or two of seed, from which it developed rye, corn and wheat, while here were the giants of nature, bearing hickory nuts, walnuts, persimmons, peaches, apples, and pears; yet very few of them have been improved, for the reason that, for the annual cropper, his grains permit of easy improvement and the big trees, with their slow generations, were very difficult to improve. Yet they are the potential heavy harvest yielders. Wherever we find land put over to tree crops, it yields several fold the annual crop. Chestnut-growing in Europe, as in Italy for example, is an established industry. Official reports show an annual production of chestnuts in Italy of thirteen bushels to the acre, and I know, by examination of the orchards, that they are not in any way in a high class condition or very carefully attended to in many localities. We average at least that, with the American standard of weight per acre, in the United States. I have not a doubt that if some of those big Japanese chestnuts were bred, selected, and hybridized, we could get varieties of chestnuts which would yield fifteen or twenty bushels per acre on the average, of first-class pig feed. Furthermore, it permits the use of land which is now entirely unusable for anything except forest, which is a very low grade producer of annual cash value. For example, to-day on the train between here and Philadelphia I saw a block of ground which covers twenty-two thousand acres,

and is itself covered with stones. It is laughed at by the Lancaster county people, and it is rocky; but chestnut trees are sticking their roots between the rocks which cover the surface and reaching down into the good, strong clay beneath, and that twenty thousand acres of good, strong clay is more potentially productive than the tops of the Apennines, which are to-day yielding thirteen bushels to the acre.

So in the chestnut we have something more to consider in potentiality than mere timber. The time is coming when we will put one hundred dollars in the breeding of tree crops and get ten thousand dollars for the people of the next decade. (Applause).

DR. MERKEL, of New York City: Mr. Chairman: I would like to ask Mr. Davis a point that does not appear quite clear to me. Was the blight kept out of the orchard, or out of the entire valley and out of the surrounding country?

PROFESSOR DAVIS: It is in the valley, but just beginning, apparently, to appear. I have hunted through there and hunted days at a time without finding any evidence. Yet I have found evidences of what apparently is the genuine *Diaporthe*, as I saw it on Long Island; and I will say that I think I saw the blight on Long Island in 1897, or 1898. It was at the time when the Long Island road was building a log cabin near Cold Spring Harbor. Mr. Jarvis was the carpenter building the cabin, out of chestnut logs, and, when he pulled the bark off, under that was found what we recognize now as the chestnut blight. Mr. Jarvis and I discussed it, and did not know what it was. It was in patches; on some of the logs which were ten to fifteen inches in diameter, the patches were as large as my hat, and I do not doubt in some cases that the trees were girdled entirely and the trees were dying. That was at Cold Spring Harbor, and I also saw some of the same thing between Cold Spring Harbor and Huntingdon, and especially back of Huntingdon, through the hills around there. So I think it was in 1898 well established in those localities. Of course, I cannot prove that is what it was, but I have seen so much of it near Cold Spring Harbor that I think it is the same thing.

DR. MERKEL: Then, apparently, the clean-cutting in this case, unfortunately, is not a proof that the fungus can be kept out, because it has not been present long enough; is that the idea?

PROFESSOR DAVIS: Yes.

DR. A. K. FISHER, of the Bureau of Biological Survey, Washington: Mr. Chairman: I would like to ask Dr. Stewart what evidence he has to show that birds are important factors in spreading the disease? Dr. Metcalf made that statement in the Farmers' Bulletin, that birds were one of the important factors in spreading the blight, but, in private conversation with the doctor, he stated that he had no positive evidence; but that birds traveled here, hence, thence, and he thought it most probable. Now the very birds which are accused of carrying blight are the woodpeckers, which are more or less stationary in their life history; especially the downy woodpecker. There is no way of telling just how far a bird will go from the nest in which it was born, but there is pretty good reason to believe that the downy woodpecker never goes over four or five miles from its home. In fact, a woodland of a few hundred acres will hold a pair or more of birds, which probably live there throughout their lives. I know of one or two pairs near Washington that we are reasonably sure to see at any time of the year. It seems to me that wind and weather, which carry other forms of diseases, are very much more liable to carry the germs of this disease. When wind will carry heavy articles a thousand miles and, it is said, carry volcanic dust half way around the globe, it seems to me that we do not have to look to birds or mammals, or even insects, as the means of spreading the disease, when other known factors are present.

THE CHAIRMAN: Dr. Fisher asks Dr. Stewart what evidence he has that birds are responsible for carrying the chestnut tree blight.

DR. STEWART: The evidence is largely inferential. This should be considered: Many of the infections,—in fact, Dr. Metcalf states a majority of the infections,—occur in the tunnels made by borers. The borers are in those tunnels. Woodpeck-

ers go after the borers. Spores are produced in enormous numbers right around those tunnels. It is inevitable that the woodpeckers will get the spores on their bills and on their feet and on other parts of their bodies. Those birds, when they go away, will carry those spores with them and leave them where they alight the next time. If they happen to fall in a wound of some kind and the conditions are favorable, the infection is going to occur. That is the kind of evidence. It is inferential. As for actually knowing that infections have resulted in that way, we have no evidence. Of course, it is exceedingly difficult, if not impossible, to get it. As to the migration of the woodpeckers, I have it on the authority of a competent ornithologist that some kinds of them do travel long distances.

DR. FISHER: There are certain forms of woodpeckers which go south in winter, but those are not the birds which are highly specialized which secure their food from the trees. They are birds which seek their food like the flicker, which feeds largely on nuts, and the redheaded woodpecker, which feeds quite extensively on grasshoppers and other insects, as well as fruits; but our woodpeckers, our native, resident woodpeckers, are rarely migrators. As to the injury to the trees, the nut gatherers, it seems to me, produce very many more wounds than the woodpeckers produce. They either jar the smaller trees with stones that break the bark and form places for the insertion of the germs, or they use climbers which injure the bark, and enter the wood very much further than the woodpecker's bill does.

MR. DETWILER: I have the report of a field agent who has been investigating the relation of birds to the carrying of disease. This investigation has been in progress only about a month, and the data is of an elementary character. However, there are two paragraphs which have a bearing on this subject. First, the field agent says:

"I can truthfully state that every blighted tree I have seen since I have begun this study, has had its bark punctured by woodpeckers, in most cases with scores of holes."

The other pertinent observation is:

"We were surprised by the large number of grubs we were able to find in infected trees. They seemed, too, to be generally distributed throughout the bark of the tree."

The inference being that the grubs attract the woodpeckers to the blighted portions of the tree particularly.

PROFESSOR DAVIS: Mr. Sober wishes me to extend an invitation to any of you, or all of you, to visit his place, when he will show you this grove in person. I forgot to mention it in the lecture, but he invites you to meet him at the Paxinos station at any time.

THE CHAIRMAN: How early are the chestnuts ripe?

PROFESSOR DAVIS: The chestnuts are ripe in the latter part of October.

DR. A. H. GRAVES, of New Haven: Mr. Chairman: There is one thing that has been overlooked here, and that is that the spores are very sticky in these exudations from the pustules. They all stick together, and the wind would carry these spores with great difficulty; so that the theory of the spores sticking to the feet of birds seems very plausible, for that principal reason. The spores might possibly be washed down the tree by the rain and mingle with the dust at the base of the tree; but, as is said somewhere by some authority, these chestnut trees do not usually grow in the dusty places. The spores that are washed down the tree would be covered up by leaves and there would be very little likelihood that the wind would carry them. I think, Mr. Chairman, the sticky nature of the spores should be considered in this connection, with the dissemination of the spores by birds and insects.

DR. W. J. GIDDINGS, of West Virginia: Mr. Chairman: I want to say something more in regard to the means of control of this disease; and I have one suggestion that has occurred to me during the afternoon and evening sessions: That is the possibility, in states where they do not feel it would be wise to make the inspection a thorough inspection, to send out men to do plot work,—I believe that is the proper term,—such as is done in forestry. They can pick out a certain small section where there are chestnuts, and determine the number of chestnut trees

there, and the amount of infection. Not only that, but they can find out if there is old infection there. In that way we can find out whether there has been infection in America for a number of years, as has been suggested by some, and possibly get those states interested, if the infection appears to be spreading. In some places that I have seen lately there was evidence of the disease working on trees that were partly dead, but we should find out more about that while the work is going on.

DR. J. W. HARSHBERGER, University of Penna.: Mr. Chairman: Professor Stewart, in his communication this afternoon, discouraged the work which is being done by the Pennsylvania Chestnut Blight Commission in the removal of trees along the outposts of the disease. I would like to present my view of the problem, because I think it is largely a question of the attitude of the State of Pennsylvania toward these larger questions of conservation which have agitated the country for the past few years.

Pennsylvania is the Keystone State. She is so situated with regard to the other states of the Atlantic Seaboard that she occupies a central position, halfway between the North and the South. It would be to the lasting shame of Pennsylvania if she would let the opportunity pass of taking some means of attempting to check the disease. The states to the south and west of us, Ohio and West Virginia, Virginia and Tennessee and North Carolina, which are very largely concerned in this movement, would point to Pennsylvania as having let the opportunity slip of doing something to check the ravages of this disease. Two hundred and seventy-five thousand dollars seems a large sum of money to appropriate for the prevention of the destruction of property; that is, it seems a large sum to use in the combating of a single disease. Yet Pennsylvania is a wealthy State, and, if we take the many millions of dollars which are at stake, the amount of money which the State has appropriated is merely a drop in the bucket, and it seems to me that the money is well spent, because we are standing, as a buffer State, between the onspread of this disease from the locality where it started, and the States beyond. In the future, when we look back on the history of the conservation movement in the United States, this move-

ment in Pennsylvania will be held up as an example of a patriotic movement of the entire people in an attempt to prevent the destruction of our native forests, which are going all too fast. So this movement, it seems to me from my standpoint, is one of the most commendable things which has been done by any State in recent years and, even if no direct result is reached, we can point with pride to the attempt which has been made to check the disease.

At one point there occurred to me a little story that was told in connection with the remarks of Professor Clinton this afternoon, when the paper of Professor Farlow was read. Professor Farlow suggested that the chestnut blight came from Italy. A friend of mine, a botanist in New York city, said that he had often noticed that around the settlements of Italians in the neighborhood of New York and Brooklyn and Jersey City, these smaller settlements that the Italians made outside the city, that the trees always died or were killed, and he thought there was some relation between the death of the trees and the settlement of the Italians nearby. So he suggested rather a curious name for this malady which attacked the trees—he said it was a form of "Dagoeatis." So perhaps, if Professor Farlow's views are correct, the trees which were killed on Long Island suffered from a form of "Dagoeatis." That, you may observe, has no scientific relativity in the discussion of this subject.

MR. CHESTER E. CHILD, President Lumber Manufacturers' Association of Connecticut: Mr. Chairman: I noticed on the map presented this afternoon that it appears that chestnut trees are practically dead in three-quarters of Connecticut. I noticed coming down on the train, between New Haven and New York, that there are a great many dead chestnut trees, and yet there remain a great many that are alive. I know that along the Connecticut River, where the blight is supposed to be working quite freely, that in a tract of timber which was sold on account of the blight being in it, it was stated that at least ten per cent. of the chestnut trees were affected. I know two men about sixty years of age who state that they are positive that they saw this blight twenty years ago, or something that looked the same as is shown in the blight to-day,—that they saw the same thing twenty years ago. I would like to ask, unless the information

is reserved to be given us tomorrow morning, whether there is any data to show what the expense is to cut out, remove and take up the infected chestnut trees where the blight is known to be working.

MR. I. C. WILLIAMS: In answer to the gentleman's question, I would like to say that the Chestnut Blight Commission has no data at hand which will answer him directly. The work of the Commission has not been specificially directed to cutting out diseased trees, but has been in the direction of urging persons to do that. It has not been possible to follow that work sufficiently closely to make an approximation of just what that cost would be. The effort that is being made in Pennsylvania will be more minutely described to-morrow morning, and I do not feel that it would be fair to trespass seriously upon that paper this evening; but what evidence there is, and what knowledge we have on that subject, will be laid before you in the morning in the first paper.

Some of the speakers this afternoon seemed to be utterly appalled at the fact that Pennsylvania has thrown two hundred and seventy-five thousand dollars into a rathole. Now it may be of interest to this meeting at this time to realize that the whole work thus far accomplished by this Commission has been at an expense of twenty thousand one hundred and forty-three dollars. That leaves a considerable margin of the two hundred and seventy-five thousand dollars upon which we are privileged to go until the first of June, 1913. (Applause).

This Commission is built upon business principles. It is not being dashed about wildly, like a potato in a tub, not knowing what it is doing or where it is going. It is trying to find its way. It may be that it will get lost in the blighted chestnut woods, but we are going to make an honest endeavor to get out of the woods. Every known method, and a lot of methods that are not known and about which we heard a good deal this afternoon, will be tried. If there is any virtue in them, they will be followed to a finality. If there is no virtue in them, we want the world to know it,—the sooner the better. The mere fact that somebody believes that something cannot be done is going to have mighty little weight in the work of this Commission. (Applause). We do not care a rap what someone's belief is. If he

has any facts to bring to us and lay before us, we are willing to accept them. We want facts; we want knowledge. We have heard a great deal about scientific inquiry. I understand that science is the pursuit of knowledge, and that its business is to get facts. Science simply describes. It has nothing to do with explanations. Therefore, if science will describe to us the things that we are trying to learn, we will be greatly indebted to science, and we by no means are in a position, nor do we wish it to be so understood that we attempt to turn our backs upon scientific inquiry. The truth is that this Commission wants all the facts it can get. It wants the help of every scientist in the land who is interested enough to pursue a line of work and make deductions therefrom that are useful in a work of this kind. We want to go hand in hand with everybody who can lend an iota of strength to this work; but we do not care to join hands with those who see simply gloom and failure, and are unwilling to make any decent effort to determine whether or not a thing can or cannot be done. The experiments that are being made by the Commission are for the purpose of finding out. We heard a great deal about the ineffectualness of the cutting-out method of combating this disease, or checking its spread. I do not know upon what foundation or upon what premises these conclusions are drawn. We have attempted to follow the progress of this inquiry and the knowledge on the subject as closely as possible, and yet gentlemen tell us that it is absolutely ineffectual. Now I would like them to tell us why it is ineffectual, and how much cutting out they have done, and what real knowledge they have derived from that kind of work. If it is going to turn upon someone's opinion, then I would like this meeting to believe that probably one man's opinion is as good as another's. If it is not, let us find out why. I would like to ask Mr. Stewart, in respect to one sentence in his paper this afternoon, which you will remember was one continued negation, I would like to ask him to tell us why in that paper he broke away from the negative attitude and, in the very closing moments, took a positive stand in that he recommended the restriction of the movement of nursery stock. Now if there is no use in cutting out a diseased tree, if there is no real effectual value in doing any work of any kind, if we are simply to sit down and let things go and take their course,

if we are going to throw up our hands in impotent helplessness and say "It is the will of Allah," why would he restrict the movement of nursery stock? If there is any real reason for that, let us have it. I do not remember that the Professor stated his reason. That is one of the questions his paper raised in my mind. I do not wish to take more of your time, because these ought to be only short discussions. If Professor Stewart would be good enough to tell us why he thinks we ought to restrict the movement of nursery stock and let everything else go wide open, I for one would like to know it, and I believe there are some others who would be interested in hearing it. (Applause).

DR. STEWART: I will answer that question in this way: That this diseased nursery stock may transmit the disease long distances. In that way the disease may take long jumps, clear across the continent.

MR. WILLIAMS: I understand from the Professor's paper that birds likewise take long jumps. What will he do with that side of the case?

DR. STEWART: We can do nothing there.

MR. A. THALHEIMER, of Reading, Pa.: Gentlemen, I rise to protect the woodpecker. (Applause). I own probably in small woodland patches, two hundred acres of chestnut. Since this blight question first came up, I have gone through nearly all my trees and I have not found a single tree that was diseased, with the exception of some near the city. I have about one hundred and twenty acres near the city, and of course, the boys,—maybe some of you have done that,—want to get the chestnuts. They bump the trees and some of them are bruised in that way. But my section is full of woodpeckers. They are not immigrants; they are stationary and they have not destroyed or infected any trees. I think it takes a long time to get at the bottom of it, and find what really is the cause. I desire to inform you of a subject in which I took a deep interest,—one which leads to this matter, During the war, in traveling through Virginia or through Maryland, you all know how scrub oaks are scattered over all that country. A scrub oak is a very small tree and does not bear any fruit at all. I often wondered where they

came from, not having been planted there. In going from here to Washington, or going anywhere, if I knew of any farmer who lived in that neighborhood, I would ask him what he knew about it, and none of them could tell me. I was anxious to know and see if I could not get that information. I wrote to the Forestry Department at Washington, and could get no definite information there. One time in moving from one house to a new house and in rearranging my library, I got hold of a book. The library had belonged to a friend of mine, a lawyer, and I got some of his books in remembrance. I looked through those books and I found a book of birds, and among them I found a picture of a bird called a "tree planter." It gave a description how that bird traveled from Maine to Florida, traveled from the north to the south and migrated again north, and they had a committee,—I do not know whether it was a Committee of Thirteen or not,—but they had a committee which would carry the nuts and plant them for food on both ways. Then, down South, they shoot these tree planters and utilize them for food, and I suppose there are not enough coming back to pick up all the fruit which is planted, and that this is the way it grows up into scrub oaks. (Applause).

PROFESSOR W. D. CLARK, Pa., State College: Ladies and Gentlemen: I came here to-day to this Conference because, being a forester by training and by profession, I am vitally interested in any movement which seeks in a practical way, to control or to eradicate the chestnut blight disease. I fully appreciate the value and importance of the chestnut tree, both as a timber producer, to enhance the aesthetic value of the landscape, as a shade tree and as a nut producer, and I heartily favor the pursuit of scientific studies and experiments in order to determine whether or not there is a practical way, within the means of human agencies, either to eradicate or control this disease. I am, however, very solicitous lest, on account of the obviousness of this disease, the directness with which it works, the quickness of its results, and the generally common knowledge of the disease, we will become blind to two other diseases of trees which, on account of their remoteness, their complex character and their slow, insidious way of working, we are apt to forget. I

refer to the disease known as an unjust and unscientific manner of taxing timber lands, and to the disease known as forest fires. Here are two diseases which threaten to destroy not only chestnut trees, but all of our forest trees. These diseases threaten not only to destroy our standing trees but to prevent, or make useless, the planting and growth of any forest trees. These diseases are not well-known diseases which are beyond our control. They are entirely within the control of human agents, and I would be grateful if I could impress upon the mind of every member in attendance upon this Convention that if we could only control the forest fires and bring about a just, scientific, and uniform system of taxing forest land, and then go ahead and plant trees, trees immune from this dreaded disease, pine trees, oak trees, hickory trees, poplar trees, valuable timber trees, we would have so many timber trees flourishing in the State of Pennsylvania that it really would not matter a very great deal if we had no more chestnut trees. We could possibly get along without them. (Applause).

MR. F. B. JEWETT, of Susquehanna county, Pa.: Mr. Chairman and Gentlemen: I came to the City of Harrisburg to-day not particularly to attend this Convention; but, when I arrived here and the programme was thrust before me, every other item of my business stopped, and I have attended your meetings and have been very much interested.

The first dollar that I ever remember of having in my life was derived from the chestnut tree, half a century ago, when, as a little boy, I picked up the chestnuts. I have been very much interested in every phase of the discussion, because, like the gentleman over here, I have several acres that have chestnut trees on them. In this evening's lecture there was thrown on the canvas a view of the harvest of that chestnut orchard in Irish Valley, near Shamokin, and in the picture I noticed the green burrs were harvested. The question that I wish to ask, if Professor Davis is present, is, how they could get those green burrs off from the trees without injuring them? All those that have knowledge from experience know that it is almost impossible to get a green burr from its native branch until the frost comes and kills the connection between the burr and the branch. I

remember distinctly a few years ago, perhaps fifteen, I made my first shipment of chestnuts to New York. I sent them to a commission merchant and I was surprised, although I knew that it was early, to receive back in two days' time returns of twenty-four dollars per bushel for that shipment of chestnuts, with this advice: "Ship chestnuts as fast as possible. Your shipment was the first that came into the City of New York this fall." I tried to get another shipment, but I could not get those burrs open, and the last shipment I made to New York that same fall brought me only $2.50 per bushel. I agree with the gentlemen that have read these very interesting papers, so very interesting to us, indeed; but so far as the spread of this disease is concerned, I am on the side of the woodpecker, because the woodpecker has been my friend from my boyhood up, and I have learned to love the music of his beak. But let me tell you, gentlemen, a few years ago I was out in Kansas, and on that wild prairie, a heavily loaded team had passed over in the spring. It was September when I was there, and across that unbroken prairie were two distinct tracks and sometimes, when the forward wheel had not run exactly straight, there were four tracks; and in every one of those tracks was a thrifty growth of sunflowers. Can you tell me how those sunflowers came there? If you will tell me that, I will tell you what spreads the fungus on your trees. It is nature. You know we all of us love up-to-date stories; we do not care about the old "chestnuts" so much. But in this case the chestnut is very important and, in closing, I want to speak a word of commendation for Mr. Williams and for the men who so wisely voted the appropriation of two hundred and seventy-five thousand dollars to this work. I appreciate it. Ever since I have been a boy, it has been grumble, grumble, grumble about appropriations and graft, and so on. New York State can sympathize with us somewhat in the matter of Capitol graft. You remember you got through with it in Albany. We got through with it without as many years of experience as you did, but I remember very well, after the old Capitol burned here, that five hundred and fifty thousand dollars was appropriated. Why, that was a big sum; but you know how that "chestnut" grew, and we got out of it with thirteen millions. I am very

thankful that the "chestnut" of the old appropriation is improving; that we have the two hundred and seventy-five thousand dollars appropriated, and that we are getting out of it with about twenty thousand dollars as far as it goes now. So I think that the State of Pennsylvania has done finely in taking the initiative in this work. I pay tax on timber, and I want to pay tax on timber-land. It is fair and square that we should pay it, and let the gentleman that complains of it remember that none of that tax goes into the State Treasury.

THE CHAIRMAN: We wish to hear Professor Clark's reply to the question, but there are a number of others who are prepared to make remarks. The Chair would ask if you have any instructions which you would give to govern our discussion from now on. Do you wish to limit the length of the remarks? I will entertain a motion, if it is your desire.

MR. E. A. WEIMER, of Lebanon, Pa.: Mr. Chairman: I would suggest that we limit our remarks to the chestnut blight. I would also suggest that the speakers be very careful not to bring out facts without careful consideration. The man on my left here talked about the spores being sticky. He did not consider that the spores were sticky only during a certain portion of their lives. Another man on my right talked about the woodpecker, but he did not consider the fact that the woodpecker does not pull out the grub with his feet, and that is about the only place he could get the spores on. We want to be very careful when we are going to get at any facts, not to hunt up facts to base our arguments on, but to base our arguments on facts. I suggest in the future that we deal only with questions dealing with chestnut blight, and accept Mr. Sober's invitation to visit his orchard when the chestnuts are ripe.

DR. MICKLEBOROUGH, of New York State: Mr. Chairman, just a word with reference to the spread of the disease by the spores: During the summer the conidial spores, those thread spores which have been explained to us to-day, are produced in myriads upon the diseased tree. The water, the rain will readily dissolve those little sticky, pasty threads and, when they are dissolved, it takes about eight or nine thousand, put end to

end, to measure an inch. They are exceedingly small microscopic objects and they are readily carried by the wind, and not very much by the woodpecker. That is my judgement of the case. The wind will carry those very readily, and sometimes to a considerable distance. I think we can account for the spread of the disease, the carrying of the spores, by the wind. Railroads are sinners to a certain extent in this matter. The trains, as they sweep through the country, will create a great deal of draft, and you will notice along certain main lines that the disease has spread with a great deal of certainty and rapidity. Now these spores, when they are lodged upon a chestnut tree, are washed down by the rain, by the water, by the dews, and you are very apt to find the disease attacking the tree in the fork of the limb. You will find it there perhaps more frequently than any other place, and there is a good place for the entrance of the spore.

Now, to digress from that for one moment, I think, Sir, that Pennsylvania has done a magnanimous and great thing, and I was very glad to hear from Deputy Commissioner Williams. We were told by the Governor that the value of the chestnut stand in this State, I think, was forty millions dollars. The Legislature of the State of Pennsylvania did not appropriate one per cent. of that which is endangered by this chestnut blight. In fact, the Governor told us the estimate was based upon fifty cents per tree. Indeed, if the statistics were carefully made, Pennsylvania has not appropriated more than about one-half of one per cent. to protect the value of a great chestnut growth. (Applause).

DR. GIDDINGS, of West Virginia: Mr. Chairman: I would like to raise some questions in connection with Dr. Clinton's statement. I infer two things from it: One is that the control of the gypsy moth in Massachusetts was not a valuable expenditure of money; another was that, by leaving off the control of the peach yellows in Connecticut, it was to the advantage of that State. I would like to ask if those inferences are correct and if Professor Clinton has data to show that the dropping of the peach yellows inspection has been to the advantage of Connecticut.

THE CHAIRMAN: Professor Clinton, can you answer those questions in a word or two?

PROFESSOR CLINTON: I do not know that I made the statement that gypsy moth work in Massachusetts was not effective. I said it meant a long fight and a continuous fight. This chestnut blight, from the re-infection, would make the fight a continuous one. You could not do it up and leave it there. You would have to keep at it forever, provided the material continued. Regarding the peach yellows law, my statement was that they dropped that. The reason it was dropped was because it made so much trouble with the farmers, by going into their orchards. You would find that same difficulty with the farmers in Pennsylvania that you would in Connecticut.

DR. MERKEL, of N. Y.: Mr. Chairman: I have been on my feet continuously ever since Mr. Williams spoke, and was about to give it up. Some of the points I wanted to bring out have already been brought out. However, I want to thank Mr. Williams. I want to thank the great State of Pennsylvania for passing that law. Pennsylvania has shown all the other States in the Union what it is to pass an unselfish law. If we could only have a Federal law that would be as broad as the law of Pennsylvania ought to be and could easily be made, by simply inserting the words after "the chestnut tree blight," "and any other fungous or insect pest," we would have no trouble with our fungous or insect pests after a certain length of time. Sometime ago I wrote that only when we considered a tree that is dangerously infected with an insect or fungous pest as dangerous as a person infected with smallpox or as a rabid dog, will we get rid in our forests of insect and fungous pests. I was very glad to hear that Mr. Williams and the members of the Commission have not become discouraged by the large amount of cold water that has been thrown on their plans. I am sure that the two hundred and seventy-five thousand dollars that the State of Pennsylvania has appropriated will never be missed, even if no beneficial results are obtained; but that the everlasting shame that the State of Pennsylvania would suffer if she made no attempt to save her chestnut trees, should be enough not to discourage any and all citizens from unselfish effort for their fellow men.

GEORGE G. ATWOOD, of New York: Mr. Chairman: There is a little desk in Albany that has been open for about a

year, and in that desk is about everything that has been said, or thought, or dreamed of, relative to the chestnut bark disease. We have had the advice of our friend Stewart, who thinks as Dr. Clinton does, along the same lines. What they have stated here to-day we must accept as the honest statement of men who know enough to make such statements. They know what they are talking about, because they have investigated this disease and they have investigated similar diseases, so that we must take what they say with a great deal of confidence. They have been talking to the point whether chestnut bark disease could be controlled or eradicated. If I were to ask either one of those gentlemen what they would do with a chestnut tree in their own yard that was infected with this disease, they would probably say, "Cut it out." That gives us the keynote of what I think should be done wherever there is a possibility that single trees, or small infections, can be removed. That seems to be the simple thing, and the proper, sensible thing to do. It may have to be done by the force of statute, but a great deal can be done by advising owners of chestnut trees that become slightly infected, asking, urging, forcing them in every way you can, to cut that timber while it is still alive and save it. If that were done in the State of Pennsylvania, their entire two hundred and seventy-five thousand dollars would be well expended. We are up against a proposition in New York. We have probably two-thirds of our chestnut timber still intact, and we want to save it if we can. Now why should we not go out in the borders and carry on a missionary work, or something stronger, and see if we cannot cut a dividing line? Let scientific men go on with their investigations. We need all the advice that their broad knowledge can bring to us; but the other thing is a practical thing, a thing that is at our doors, and a few hundred thousand dollars spent now may result in a saving of that valuable property lying all to the west and south of us. (Applause).

DR. J. RUSSELL SMITH, of Pennsylvania: Mr. Chairman: Professor Clinton advanced a very interesting point; that it was the dry weather that made these trees amenable to blight. The evidence was that people in Connecticut thought the dry weather had killed other trees that died, if I remember the

gentleman correctly. It seems to me that that matter of the drought would be much better tested by showing that, in localities of low, moist, abundantly watered soils, the trees had not had blight. There must be many such localities of chestnut in Connecticut where even the recent droughts of past years have not subjected many trees to a dearth of water.

THE CHAIRMAN: Can you answer that in a word, Professor Clinton?

PROFESSOR CLINTON: I was giving the various things that weaken trees. Drought is one of them. We have had severe droughts in Connecticut, and I hold that the situations that have been the most moist have been the regions that have suffered most from the drought, because when a tree is trained to live in a moist place, during a drought it will suffer more than a tree on higher land which has been used to dry soil.

MR. CRANMER, of Pennsylvania: Mr. Chairman: While still well on the sunny side of life's meridian, I distinctly remember, as a barefoot boy on a little farm on the eastern seaboard of New Jersey, the advent of what was known then as the Colorado beetle, commonly called the potato bug. As a little boy about this high (indicating) I was put in between the rows to catch those fellows and get them off the vines. Naturally they appeared on the vines of other farmers in that section, and many of the old fellows shook their heads in despair. They said "We will never raise any more potatoes. The potato crops are done in America." My father did not feel that way, although I would have been pretty well satisfied if he had. He made me hunt potato bugs, and then we later began to use the London purple and the Paris green, and so forth. We are still raising potatoes in New Jersey and other places throughout the United States, with success. We still have specimens of the Colorado beetle in the United States, but we expect to go on raising potatoes, and doing our best. So it seems to me, gentlemen, in relation to this chestnut bark blight, this chestnut tree disease, we are not to hold up our hands in despair and listen to too much of the expert advice and opinion that falls from the lips of our university men. I come from a university myself, and I dare say that. We have heard much to-day. There have been numer-

ons expressions of opinions and of guesswork. We have yet to hear from any person who tells us what he has done in a practical way for the cutting out and eradication of this disease in any extended form and over any very large tracts of land. I am unfortunate in the fact that my chief, who is custodian of all the property at Lehigh University, is not able to be here tonight, Dr. Henry S. Drinker, whose name appears in the roster of officials of the American Forestry Association, and who is president of Lehigh University. He is custodian of a large tract of land, adorned on its campus with many primeval chestnut monarchs from eighteen inches to three feet in diameter, giants of the old forest tract. In the rear of this campus we have some two hundred acres covered with a coppice growth of chestnut and various hardwoods of Pennsylvania. We were exceedingly fortunate, some years ago, in having heard from the lips of Mr. C. W. Levitt, an eminent landscape engineer of New York City, the warning that our chestnut trees were likely to be visited with an insidious enemy, which would destroy them all. It was not, however, until the summer of 1908 that I as custodian of those grounds, saw any unusual discoloration on either the bark or foliage of a chestnut tree, except that which seemed to be natural in the decay of any specimen of deciduous trees. During that summer I saw, on a small chestnut, this unusual discoloration and the appearance of small red or brown pustules. This tree was immediately cut down and portions sent, after all other portions were burned, to Mr. I. C. Williams, Deputy State Commissioner of Forestry of Pennsylvania, who placed it in incubation and pronounced it the chestnut bark blight, or disease. I am not familiar with the scientific name. I was then cautioned by the president to be careful, observant, and vigilant, and to watch for any recurrence of this thing. To hasten from that time on, through the summer of 1910, when it appeared, and in 1911, we have done exactly as was recommended to us by Mr. Williams and by Dr. Rothrock, who visited us during this period of time and walked through our coppice grove of chestnut. I am *not* able to say, after extended experience along this line, that all trees which are treated by severe pruning, which have been touched by this blight, may be saved. We do know, however, that we have tided trees over one year and two

years, that were striken with the blight, by removing all such portions as were affected by it, treating them with a composition of coal tar, diluted slightly with spirits of turpentine, so that it might be easily applied with a brush, using it both as a fungicide and insecticide; using it on bark, wood, and broken places. Thus far we feel that our work has been successful along this line. Last year it is true we cut out forty trees, all of them less than ten inches in diameter. We have as yet lost but three trees in all this large tract of land that were more than this size. We have, as I said before, saved many trees by severe pruning and trimming, cutting out all diseased places and treating them with this solution of coal tar, ordinary coal gas tar; so that we feel it is worth while to do something along this line. We do not feel like the dear old lady who stood up on the banks of the Hudson River when Mr. Fulton was about to experiment with his steamboat, and said, as it was puffing and blowing, "It will never move, it will never move," and when the ropes were cast off and the boat moved out into the stream, she said "It will never stop, it will never stop." We hope this will be a successful work, prosecuted for the highest end by this worthy and able Commission of the State of Pennsylvania, and we, as representatives of Lehigh University, Dr. Drinker, Professor Hall, of the Department of Biology, and myself as custodian of the grounds, stand ready to help you with anything we can do for you. We stand ready to listen to what you say to us, stand ready to take your advice as a Commission, and go with you hand in hand along this line. (Applause).

DR. H. S. REED, of Virginia: Mr. Chairman: Regarding one of Dr. Smith's questions, we have a few observations upon the chestnuts in Virginia. Reference has been made this afternoon to the blight in Virginia. It has been found there in some instances,—probably there is more there than we think,—but we have observed this that wherever it has been found, that it was at an altitude of less than 800 feet. Most of the chestnut timber that is healthy, and the greatest majority of it, is at an altitude of more than a thousand feet, and on none of that which is more than a thousand feet above the sea level has any trace of the blight been found; but it is found occurring at altitudes less than 800 feet and in regions where the rainfall is great.

THE CHAIRMAN: On account of the particularly interesting address that we heard from Professor Davis to-night, the Chair thought that there would be some questions directed to him, but it seems that the discussion has gone along on somewhat different lines. There is one question however, which Professor Davis has not answered, with reference to gathering the crop while it is still green, if I remember the question. Will Professor Davis kindly answer that question?

PROFESSOR DAVIS: In September, when the burrs are green, you can shake them from the trees as you can apples, and the entire crop has been harvested without frost. When they are shaken off, they are allowed to dry a little while. When you shake them off in September they color up brown and the frost, I think, has nothing to do with it.

THE CHAIRMAN: This note has been sent to the Chair: "Will you please ask Dr. Spalding, of the United States Bureau of Plant Industry, what has been done in the vicinity of Washington, D. C., to prevent the spread of the chestnut bark disease?" Of course, it will be impossible now to go into that subject at length, but if Dr. Spaulding will tell us, in a minute or two, something of what has been accomplished, and in a word, the main features of the method, I feel sure it will be appreciated.

DR. SPAULDING: I am not very familiar with the work that has been done in the vicinity, because I have been working on other problems most of the time during the last few years. I simply know, in a rough way, that the method of cutting out had been practiced wherever diseased trees have been found and, as far as I know, that has been fairly successful. There are cases where spores have been found on the stump of an old tree. In many cases, I am sure from Dr. Metcalf's statement, no special precautions were taken to remove the diseased chips, or even to remove the bark from the stump, so that certain cases might very well be expected to have the fungus at this time.

THE CHAIRMAN: It seems now, the time being half past ten, that we had best do one of two things: either take a recess until to-morrow morning at sharp nine o'clock, or decide to spend

the rest of the night here and finish this subject The Chair learns that Mr. H. P. Marshall is not here and therefore cannot serve on the Committee on Resolutions for New York. He will ask Mr. Merkel to take his place. This Committee will meet at the right of the Chair immediately after adjournment, only for a minute or two.

MR. THALHEIMER, of Reading, Pa.: Mr. Chairman: I was listening to the gentleman from New York. I think he has the proper theory, that is, that the spores are spread by the wind blowing them from place to place, and just according to how the wind blows at a certain time. Take the Orlansa tree. It is called Orlansa in Latin, Lancewood in English and Paradise tree in German. It is a tree like a sumac. There is probably one out of fifty that has a seed on it, like grapes, and at certain times of the winds they are blown for thousands of feet. Some may land between the mortar, or between the bricks, of a building, and a tree will grow there. If you go up Third street from the ferry after you land there, you will see here and there and everywhere in the front yards a nice little tree growing there, if they have let it grow. You have all seen that, especially in Washington. That seed is just like a leaf, and it is as sharp as a knife, and the seed is encased in that leaf and that gets into any crevice. I have had some taken out of my wall that grew there, and they would grow to a good size. I have seen them grow out of a brick pavement, where there was not any sweeping or any work done around.

THE CHAIRMAN: As President Drinker cannot serve on the Committee on Resolutions, Mr. Green is asked to serve in his place.

We will now take a recess until nine o'clock to-morrow morning to meet again in this room.

(Adjourned until Wednesday, February 21, 1912, at 9 o'clock A. M.)

MORNING SESSION.

Wednesday, February 21, 1912, 9 o'clock A. M.

THE CHAIRMAN: The meeting will please be in order. We have a busy session before us and in a few moments opportunity will be given for the presentation of such business as ought to come up, and then we will proceed with our programme. It has been suggested to the Chairman, and he very heartily approves of the suggestion, that we should start our morning session with a good taste in our mouths, which would be provided by hearing a few remarks from our old friend, Dr. J. T. Rothrock, who is recognized as the father of Pennsylvania forestry conservation, and, if there is no objection, the Chair will change from the established order to call upon Dr. Rothrock for a few remarks at this time. (Applause).

DR. JOSEPH T. ROTHROCK: Mr. Chairman and Gentlemen: This question of chestnut blight, although of course it is a portion of the forestry work of the State, is somewhat foreign to the line in which I have been most actively interested. I would say, though, that it was my good fortune in 1880 to spend nine months in the laboratory of Professor DeBarry at Strassburg, Germany. DeBarry at that time was recognized as the leading fungologist of the world. I departed from the faith that was in me then, not because of lack of interest in the field, but because my eyesight gave out, and I drifted then into forestry. So that you will see that I am not wholly without a knowledge of the rudiments of this work that you are engaged in.

Now when a contagious disease breaks out among men or among domestic animals, the first thing that is done is to limit, as far as possible, the spread of the infection, or of the contagion. Meanwhile, the laboratories of the land are doing all they can to find out the causes and what is to be done to end the trouble. The two lines of work are progressing side by side. When the Peronospora invaded the vine-growing districts of France and Germany, the laboratories of the Old World were busily en-

gaged in finding out how the fungus that produced the trouble in the wine-growing districts found its access into the vines. I had the pleasure of having Professor DeBarry point out to me himself the first spore that I ever saw, sending its germ threads down into the tissue of the plant. I do not know who discovered the Bordeaux mixture, but I do know that that was very influential in limiting the spread of the disease and restoring the wine industry to its normal and natural condition. I do not believe, however, that it was discovered by our scientific friends; but they did discover the life history of the disease, which was a most important, permanent contribution to the vine-growing, wine-producing industry of the Old World. Now it seems to me that we are in a somewhat similar condition here. We have with us a pest, which is destroying our forests. It seems to me that the proper thing to do is to destroy every spore-producing specimen that we know is actively engaged in disseminating and widening the area of the disease. That would seem to be one commonsense remedy to adopt. It is along the line of what we know in the treatment of contagious and infectious diseases. In the meanwhile, let our laboratory men go on with renewed energy and keep up the work. I think that every State in this Union ought to have a laboratory of well equpiped scientific men, men who follow their work not for their salary but for the love of the work. Those are the men that give you the permanent results. I would like to see every State in this Union have a laboratory well equipped and well provided with all that is necessary to produce effective work. Mark Twain on one occasion made the remark that they had a queer way of dealing with criminals out West. He said "They hang them first and try them afterwards." Now it seems to me that we have the known criminal with us here. Let us hang him first and then let our laboratory friends try him in the meanwhile. (Applause and laughter).

MR. HAROLD PEIRCE, of Pennsylvania: Mr. Chairman: I move that at 11.30 A. M., the Conference take a recess until two o'clock, and at that time, 11.30 A. M., the Committee on Resolutions meet in the House Caucus room. I would also move that no resolutions be received after 10.30, and that up

to that time, all resolutions that are desired to be brought to the Committee on Resolutions be sent to the desk, to be presented to the Resolutions' Committee.

Seconded by Dr. Russell Smith, of Pennsylvania.

THE CHAIRMAN: The motion is that we adjourn this meeting at 11.30, to reconvene at 2 o'clock, and that at 11.30, the Resolutions' Committee meet in the House Caucus room, which is below this room, on the main floor, and that no resolutions be received after 10.30 this morning, and that all resolutions should be presented at the desk during the next sixty minutes. You have heard the motion, which has been seconded. Are there any remarks? If there are no remarks, we will call for a vote.

The motion was put and unanimously carried.

MR. PEIRCE: I have a letter that has been sent me, that I think it would be well to have read.

THE CHAIRMAN: Let the Secretary read the letter.

Secretary Besley read the following letter, written upon letter head of the Harrisburg Board of Trade:

"Dear Mr. Peirce:

It occurs to me to suggest that it might be well to have Mr. Pearson call the attention of the chestnut tree bark disease conference to several things relating to the stay of the delegates in Harrisburg.

1. The Capitol Building, itself easily one of the ten great buildings of the world, with its appropriate and memorable art decorations, is an exhibit worth looking at. There are courteous guides at hand to explain to visitors its features.

2. The State Museum, housed in the Library building, just south of the Capitol building, is almost unique in character. It presents an epitome of the life and manufactures of Pennsylvania.

3. The City of Harrisburg is a civic exhibit well worth the attention of any visitor to the conference. It has in ten years made more progress, in proportion, than any other city in the United States, toward true civic improvement. Its two-mile-improved water front, open to the public; its 55 miles of paved streets; its great park system, including 749 acres, which last

year cared for more than a million and a quarter visitors; its notably efficient and pleasing water filtration plant, open to visitors, on Island Park; its dignified city entrance, at Market Street and the river,—all make it worth a look from those in attendance upon the conference.

I have instructed the secretary of our Board of Trade, Mr. James A. Bell, to present this to you and to proffer his assistance in connection with any information about the city.

Congratulating you on the already apparent success of your splendid work, and on the monumental and unique character of this conference, I am

Yours truly,

J. HORACE McFARLAND,

President."

THE CHAIRMAN: The Chair would suggest that if President McFarland will kindly do so, it would be most agreeable if he would be in the ante-room at the close of this session, to meet delegates who desire to secure further information or suggestions from him. Certainly his letter is much appreciated. Is there further business to be attended to at this time? One of the first rules of physics is that two objects cannot occupy the same space at the same time. The Chairman is reminded of this rule when he looks at the programme and reflects upon several requests that have come to him for other matters than those mentioned on the programme to be presented in the short session of this morning. The fact is, we have now just two hours, and a programme which easily could occupy double that time. If members wish to give instructions for the guidance of the proceedings this morning, it might facilitate matters.

MR. SHEPPARD: Mr. Chairman: I move you that the Chairman be empowered to confine all discussions to three points upon this morning's programme, and that all talks on these subjects be limited to three minutes.

Seconded by Mr. Merkel, of New York.

THE CHAIRMAN: The motion is the discussion on this morning's session shall be confined to the three points on the

morning programme. It woud save a little time if Mr. Sheppard would tell us just how he defines those points, there being four papers.

MR. SHEPPARD: First, the Pennsylvania programme, the third, the chestnut blight and the future of the forests, and the fourth, the chestnut blight and constructive conservation. The second item (reports of the State Foresters), is one that would be so general that it seems to me we could hardly get very far with it.

THE CHAIRMAN: It is moved, then, that we confine discussion to those three subjects, remarks to be limited to three minutes, which, of course, would govern except by exception being made by unanimous consent.

PROFESSOR CLINTON, of Connecticut: What is this? A Pennsylvania Conference, or a Conference of the United States?

THE CHAIRMAN: Are there other remarks?

PROFESSOR HOPKINS, of Washington: It might be well, Mr. Chairman, to state some additional subjects that are to be presented this morning, to be taken into consideration along this line. We would like to discuss the insects before we are through.

THE CHAIRMAN: There have been numerous suggestions that we should give some attention to insects.

MR. PEIRCE: I think it would be well for that resolution to carry this morning, not in order to cut off discussion, but because the programme this morning was formed for constructive work and for utilization; and I think it would be well if we would carry out that line this morning. An opportunity will be given this afternoon, I should think, for all other subjects to be presented. If we confine ourselves to the one thing that is specially mentioned in those three subjects, I think we can get more effective work that if we try to have a diverse discussion this morning.

THE CHAIRMAN: If you observe the subjects on the programme I think you will find that they would not confine discussion to Pennsylvania questions. Are there further remarks?

MR. CASSELL, of Pennsylvania: Do you think it might be well, under the circumstances, to make No. 2 on your programme No. 4? Then, if we have time for it, it could come up and some of our friends, who have come prepared to report under that, would have their opportunity.

THE CHAIRMAN: Do you offer that as an amendment?

MR. CASSELL: Yes, sir.

THE CHAIRMAN: An amendment is offered, that question No. 2 follow No. 4. Is the amendment seconded?

The amendment was seconded by Mr. Peirce.

THE CHAIRMAN: Do you wish to take any further action, or suggest any further action? If not, we will put the amendment first.

The amendment was put and carried.

THE CHAIRMAN: Now you have the original motion as amended, that discussion be strictly confined to the three subjects. Is there any desire to open up the insect question this morning? If so, we should hear another amendment.

PROFESSOR CLINTON: I understand that Mr. Hopkins has something to say, and I, for one, should like to hear what he has to say. I move that, at sometime at least, we hear from him. I do not care whether it is this morning or this afternoon.

THE CHAIRMAN: The Chair would be glad to entertain an amendment.

PROFESSOR RANE, of Massachusetts: It seems to me that we are losing a good deal of time on these amendments. I should like to hear the papers, and then also hear Professor Hopkins on the insect question.

MR. PEIRCE: I would move that Professor Hopkins present his paper at two o'clock this afternoon.

The motion was seconded.

THE CHAIRMAN: The Chair has one motion before the House, to confine the discussion to three subjects and remarks to three minutes in each case.

(The motion was put and carried).

THE CHAIRMAN: Mr. Peirce makes a motion that Professor Hopkins be requested to speak on the insect question at two o'clock this afternoon.

The motion was seconded by Mr. I. C. Williams, was put and duly carried.

THE CHAIRMAN: Having executed the criminal, we will proceed with the trial, and ask Mr. Hopkins if that will be agreeable to him.

PROFESSOR HOPKINS: I had planned to leave for Washington directly after dinner, at least at three o'clock, and I am afraid that will interfere with my plans; but, if it is the wish of the meeting, I will submit.

THE CHAIRMAN: It would be very kind of Professor Hopkins to remain over. It seems almost the unanimous wish. We will proceed with the morning programme, the first paper being "The Pennsylvania Programme," by the first secretary of this Conference and the executive officer of the Chestnut Blight Commission, Mr. S. B. Detwiler. (Applause).

THE PENNSYLVANIA PROGRAMME.

By S. B. DETWILER, EXECUTIVE OFFICER, PENNSYLVANIA CHESTNUT TREE BLIGHT COMMISSION.

Mr. Chairman, Ladies and Gentlemen: Although a determined effort to control and eradicate the chestnut bark disease was made by a number of public spirited citizens, residing in the vicinity of Philadelphia, it soon become evident that they were unable through individual efforts, to save their valuable chestnut trees from destruction. As a result, Pennsylvania took up the fight against this destructive tree disease in earnest, realizing the necessity for prompt and vigorous action on the part of the Commonwealth. A Commission was appointed in

June, 1911, for the purpose of thoroughly investigating the chestnut blight, to devise and apply ways and means through which it might, if possible, be stamped out.

In 1909, according to the report of the State Auditor General, there were 7,633,180 acres of forest land in Pennsylvania, of which it is estimated that 21 per cent., or approximately one-fifth, is chestnut timber. Allowing two poles, four ties, and two cords of wood per acre, and allowing $2.00 per pole, 33 cents per tie, $1.00 per cord for wood, the total value of the chestnut timber in Pennsylvania would be $55,000,000, in round numbers. If we allow $15,000,000 as the total value of the nut crop, and orchard, park, and shade trees, the total value becomes $70,000,000. This does not consider the value of chestnut forests as protection for water-sheds. By dividing the counties in the eastern half of the State into zones, as shown on the map, on the same basis as the above estimate is made, the value of the chestnut trees already killed or affected by blight in Pennsylvania is estimated at $10,000,000. Of this amount $7,000,000 is the value of poles, ties, and other wood products, and $3,000,000 is estimated as the value of orchard, park, and shade trees, the loss to nurserymen, and to real estate owners. It is believed that $3,000,000 is a low estimate for the value of these trees, since the loss to real estate owners and to owners of shade and orchard trees has been particularly severe in the southeastern corner of the State where the chestnut tree is of great importance in this respect.

No reliable estimate of the annual income from the sale of chestnut products in Pennsylvania can be given. The statistics of the Forest Service, for the year 1909, show that for the United States, the value of the annual cut in that year was approximately $20,000,000. Of this amount, about one-half was the value of lumber, lath, and shingles, the other half representing the value of poles, ties, and extract wood.

The Pennsylvania Chestnut Tree Blight Commission began its investigations in August, 1911. The general plan adopted by the Commission is that recommended by Dr. Metcalf in his recent bulletin on the control of the chestnut bark disease. In brief, this consists in first determining the exact range of the

disease, especially the advance points of the infection. The diseased trees of these spot infections are destroyed as soon as possible after being located. Ultimately, it is planned to establish a zone free from the disease which will be constantly patrolled for new infections. The portion of the State west of this zone will be thoroughly scouted over at least once each year and new spot infections eradicated as soon as found.

East of the immune zone no immediate attempt will be made to eradicate the disease, partly because most of the energy will be required to fight the disease in the immune zone and westward, and also because of the poor market for chestnut products, especially cordwood, of which a large amount will be produced. It is planned, however, to place competent men in the region of general infection for the purpose of encouraging timber owners to cut their diseased trees before they deteriorate, and to assist them in finding a market for this material. In communities east of the general advance line where the per cent. of blight is not high and the owners desire to co-operate in cutting out the diseased trees, the Commission plans to give all possible encouragement and assistance.

At the risk of being tedious, I will give a resume of the provisions of the Act which governs the work of the Pennsylvania Commission.

Section 1. A commission consisting of five persons, to serve for three years, is created.

They are given power to use all practical means to destroy the chestnut tree blight.

The Department of Forestry is directed to work in collaboration.

Section 2. The Commission and its agents or employes are given power to enter upon any property to determine whether trees are attacked by blight. They are directed to co-operate with owners for the removal of the trees and eradication of the disease. The commission will furnish every owner with information respecting the location of his blighted trees.

Section 3. If an owner refuses to co-operate with the Commission in applying remedies or doing any act directed to be done to prevent further spread, the Commission may give him

twenty days' notice that it will proceed if he does not. At the end of the period of notice the Commission may cause trees to be destroyed and the cost of doing such work is collectible from the owner; and if the cost be not paid within sixty days, the Commission is directed to proceed by action at law.

An owner may appeal from the decision of a member of the Commission or any of its agents or employes, within ten days after receiving his notice. The Commission will then direct a re-examination and accord a hearing to the person making the appeal. Proceedings in the meanwhile will stay.

Section 4. The Commission is given power to establish a quarantine or destroy trees not affected by blight, if so doing will result in preventing spread of the disease. Good trees so destroyed are to be paid for at current stumpage prices. In case an owner be dissatisfied with an amount allowed him for the destruction of good trees, he may appeal to a court for such remedy as he thinks he may be entitled to.

Section 5. Violations of this Act or any of the regulations adopted by the Commission, or resistance to an officer of the Commission, are declared to be a misdemeanor, and upon conviction, the defendant may be fined $100 or imprisoned one month; and the provisions of the Act are extended to corporations as to individuals.

Section 6. The Commission shall receive no pay but actual expenses only. The employes of the Commission are to receive such compensation as the Commission may determine.

The superintendent of Buildings and Grounds shall furnish them with suitable offices.

Twenty-five thousand dollars is appropriated for scientific research and office expenses, and $250,000 additional for general field work.

Section 7. Repeals all inconsistent legislation.

A quarantine on the shipment of chestnut nursery stock was declared by the Commission soon after its organization. Regulations were made requiring that all nursery stock prior to shipment be inspected by an agent of the Commission and dipped for several minutes in an approved fungicide, preferably Bordeaux mixture, in the presence of an inspector. Nurserymen are pro-

hibited from shipping, and transportation companies from carrying chestnut stock not bearing the Commission's tag. Chestnut nursery stock shipped into the State from without is to be held at the border of the State for inspection. The nurserymen and transportation companies of the State deserve credit for willingly co-operating with the Commission to make this regulation effective.

A field force of over thirty men has been organized and the extent of the blight in the State has been determined approximately. The infected region in Pennsylvania occupies the eastern two-fifths of the State. The western-most line of general advance may be shown by drawing a line from Susquehanna to Williamsport, and southward through Huntingdon to the southern boundary of the State, although there are scattered spot infections west of this to near the Ohio State line, in the southwestern corner of the State. The field work done by the Commission last summer and fall was largely scouting to locate the extent of the disease. From January 15 to February 15, 1912, 1,352 infected trees on 87 tracts have been disposed of according to the regulations of the Commission, and fully as many more are in the process of removal. This is part of the work, in addition to general scouting and the holding of meetings for the purpose of educational work on the part of the field agents. During the summer months, when the work is carried on to the best advantage, it is planned to increase the field force so that the State may be thoroughly scouted and all diseased trees cut out west of the advance line.

On the advance line and to the westward, the owner of the trees marked for removal is required to burn the bark from visibly diseased or cankerous portions of the trees. He is also required to destroy the bark of the stumps of infected trees, either by peeling the bark to the ground line and burning it, or by burning the brush over the stump until the bark is consumed. Experiments are being tried to determine if it is not practical to cover the stump with kerosene, crude petroleum, tar, or some similar material, to make the destruction of the bark thorough and less expensive. A trial shows that one man at this season of

the year can peel six stumps 10 to 15 inches in diameter in an hour. That is a conservative figure.

It is the policy of the Commission to use every possible means of securing the co-operation of owners in cutting infected timber, before resorting to their power under the law. The power that the law gives the Commission is sufficient to insure respect for its powers, but we realize that the law alone is not sufficient to make the plan of controlling this disease effective unless it is backed by strong public sentiment in its favor. This is being accomplished by educating the public to recognize the symptoms of the disease and to realize its serious character through lectures, field meetings, circulars, newspaper articles, and other work of an educational nature, such as interesting school children and boy scouts in the movement. So far, no serious opposition has been met with in the work of eradication; on the contrary, we have had exceptional co-operation from all classes of timber owners.

The Commission maintains a laboratory for determining doubtful infections, and for conducting experiments in the control of the disease through the use of sprays, fertilizers, and medications. The Commission is giving an impartial trial to the many remedies submitted, to determine their effectiveness. These experiments are being pushed forward as rapidly as may be done, but no remedy will be endorsed by the Commission until its efficiency has been demonstrated beyond all doubt. Most of those submitting remedies for the blight have in mind the size of our appropriation rather than the practicability and efficiency of their remedies to the public.

The Commission keenly realizes its responsibility to the public for the proper expenditure of the funds placed at its disposal. Yesterday's proceedings of the conference emphasized the great need for comprehensive scientific investigation into all phases of the blight problem. It is only by finding out all the facts relative to the disease that we can hope to eradicate it, and it is evident that many scientific facts of practical importance are still unknown. For instance, it has not yet been definitely determined what agents are of primary importance in distributing the spores, or to what extent the disease may be spread by the

transportation of barked and unbarked products of diseased trees, two points which have a direct bearing on cost and efficiency of control.

The woodpecker and other birds have been blamed for spreading the blight, when in my opinion it is more apt to be the fault of insects. Further investigations may prove this to be as much a problem for the entomologist as for the pathologist. We feel a sentimental interest in the birds. Nevertheless, this does not free us from also investigating them to find out scientifically their exact relation to the spread of this disease. In other words, we must investigate everything, whether we believe one thing or another. At the present time three field agents have been detailed to make special studies of field conditions for the purpose of securing further facts relative to several of these problems. Many lines of co-operative investigation and experiment are in progress and others are planned. Detailed knowledge of the agents causing infection and the time of year when infection occurs, which will be obtained as the work progresses, will undoubtedly assist in making control more effective and in cheapening the cost of the work of eradication, by pointing out the simplest methods required to give satisfactory results. In the meantime, however, it is our belief that sanitation is practical and should give good results in checking the spread of this disease as it has done in the case of other diseases. Quarantine measures proved successful in checking outbreaks of yellow fever *after the mosquito was convicted.* It is more than probable that by destroying the diseased bark of infected trees in the eastern half of the State, we shall also destroy the agency which spreads the disease.

In my opinion, the big problem which confronts us and which more than any other will determine the success or failure of our undertaking is the question of profitable utilization. A satisfactory market for the various classes of chestnut wood which must be disposed of as a result of the cutting-out method of control, appears to me to be vital to the ultimate success of the plan. The active co-operation of chestnut owners cannot be willingly secured if they must do the cutting at a loss. We have found that owners who were reluctant to cut have been

willing to do so after they found a market for the product which enabled them to follow our regulations without expense, or perhaps at a profit. The Commission, by acting as a clearing house to bring buyer and seller together, will be able to assist materially in solving this problem. There are over thirty commercial uses for chestnut wood, and it seems likely that all the chestnut wood which will be produced can be utilized, provided it can be delivered to factories and other consumers at a price which will allow it to compete with other woods. The solution of this problem seems to lie in lower frieght rates on chestnut products. All classes of chestnut products will probably become more or less of a glut on the market, unless rates can be secured which will enable such material to find a market over a much wider territory than at the present. The greatest present difficulty however lies in the disposal of chestnut cordwood.

Pennsylvania's programme may be summed up as doing all that can be done along the lines indicated to save the chestnut trees. If successful, we shall be most happy; if we fail, after an honest fight, we shall have the satisfaction of knowing that it has been money wisely spent. Even though we accomplish no more than to secure the best utilization of the blight killed material, the expenditure of money and effort is justified; and in addition, we have the educational value along forestry, conservation, and pathological lines; an object lesson to the State and Nation, of which we must not lose sight.

Pennsylvania hopes for two great results from this conference; first, the united effort of the states here represented in attempting the control of the chestnut blight, and second, assistance from users of chestnut products in devising ways and means of profitably disposing of the products of diseased trees. The other thing needful to ultimate success, that is, the complete scientific facts of the disease, will be obtained in the course of time through systematic investigation, through the collection of facts, not through hypotheses. (Applause).

THE CHAIRMAN: The next paper is entitled "Chestnut Blight and the Practice of Forestry in Pennsylvania," by Dr. H. P. Baker, Department of Forestry, State College, Penna.

THE CHESTNUT BLIGHT AND THE PRACTICE OF FORESTRY IN PENNSYLVANIA.

BY DR. H. P. BAKER, PENNSYLVANIA STATE COLLEGE.

Mr. Chairman, Ladies and Gentlemen: I am glad indeed of this opportunity of presenting a very informal paper, and I wish you would consider it as an introduction to discussion only. I feel like apologizing a little for presenting so short a paper. In fact, I received a telegram in regard to it just as I was leaving State College and have not been back to the College since, so that what I have gotten together has been on the run and I am afraid will not be facts entirely.

The Chestnut Bark Disease *(Diaporthe parasitica),* which was first observed in this country in 1904 in the vicinity of New York, has now spread through the hardwood forests of ten to twelve of the eastern States. Up to this time the loss from destruction of chestnut trees of all ages has probably been more than fifty million of dollars. (From Mr. Charles Marlatt, of the Bureau of Entomology, United States Department of Agriculture in National Geographic Magazine). The chestnut, because of its sprouting capacity, rapidity and vigor of growth, and the natural durability of its wood, is one of the most valuable hardwoods of our eastern forests. It is especially valuable for farmers' wood lots, because of the simplicity of management necessary to produce repeated yields of posts, poles and ties, and that within a shorter time than possible with any other common hard wood, or wood of equal value. The length of rotation for production of posts and poles may be made so short, with proper care and protection of the wood lot, that the ordinary cry of too long an investment for profit will not apply to the growing of chestnut under simple coppice. By simple coppice we mean the cutting of the forest and its reproduction by sprouts from the stumps. This method has been praticed by our wood lot owners for a good many years. They have not called it simple coppice, but it has been that just the same, and they have been practicing it very successfully indeed.

I cannot believe, in view of the great value of chestnut wood and the rapidity and vigor of its growth, that we can get along without it in our Pennsylvania forests, or in our eastern forests. I am optimistic naturally, and I do not believe that we will ever carry on forest management in this country without using chestnut.

With the possibility of the complete *commercial* destruction of this valuable tree, it is indeed time that the foresters of the country consider what the effect of the removal of this tree will have upon the future of the forests and whether or not the introduction of some special method of management may not make it more difficult for the disease to spread or make it easier for the tree to resist the disease by keeping it in the most healthful and vigorous growing condition. These are not easy questions to answer, because we have no precedent to follow, either in the practice here or abroad. We have never had such a serious enemy of the forest working in a well settled region of the country, and at a time when both the national and state governments are so well disposed to appropriate sufficient funds for combating the pest. In the State of Pennsylvania we are now carrying on work against this disease which was undreamed of when we were suffering earlier from special insect devastations in our forests.

A very brief statement of the devastations of two similar pests may help us to appreciate somewhat our problems in connection with the blight. In 1882 the Larch Saw-fly worm appeared in the native larch or tamarack in Maine, and during the next five years did tremendous damage throughout northern New England and New York. By destroying the needles of the trees it caused their slow death and not until the territory had been pretty thoroughly covered by the insect and until certain natural enemies arose did this insect finally disappear. Nothing, of course, was done to combat the insect or prevent its spread. While it was not possible to estimate the damages resulting from the work of this insect, it must have exceeded several millions of dollars. There was no serious re-occurrence of this pest until last year, when it appeared in the tamarack swamps of the Northern Lake States. It is reported that Michigan is studying this pest with

the hope of being able to do some effective work against it. I mention this pest because it practically wiped out the tamarack in northern New England as a commercial tree, though after the pest had passed there were single trees and also considerable areas left that were not touched at all. We heard little of it, because there was lots of timber everywhere else, and people were not interested. It was not brought home to them as the work of this chestnut disease is here in Pennsylvania. Yet the tree was not wiped out entirely, and I cannot believe that, even though this blight disease may spread ever so widely through the Appalachians, that the chestnut will become extinct.

The second and better known devastation of forests by an insect was that of the Nun or Spruce Moth which appeared over considerable areas of the spruce forests in southern Germany in 1891 and 92. Bavaria alone spent over three hundred and seventy-five thousand dollars in combating this insect and finally by the use of bands or rings of viscous tar on the trees prevented the upward movement of the larvae from the ground and thus the pest was destroyed. Great areas of forests were clear cut and the market was glutted with spruce poles and logs of certain sizes. Dr. Endres, the great forest statistician of Munich, reports that even though there was an apparent over-supply of timber from these clear cuttings, yet the market did not suffer and a good average price was received for all material. The methods followed in Europe for combating either insect or fungous pests are hardly applicable here because of their denser population, cheaper labor and smaller and more accessible forest areas.

Much was accomplished in Bavaria and the states of southwestern Germany by the clear cutting of the forests in broad strips. In replanting these strips some attempt was made to replace the spruce by species not susceptible to injury by the moth. This, however, was not followed out to any large extent, because the spruce is the most profitable tree for southern Germany. I believe that no system we may use in wiping out this chestnut disease, if we are able to do it, will preclude the use of chestnut in our future forest management. The forester is going to grow the tree from which he can make the most money, if the

agencies of nature will let him do it. Of course, the agencies of nature are against us now in this chestnut disease fight. Strips of forest in Germany often a half mile wide were left while the cleared areas ranged from a dozen rods up to a quarter mile in width, depending both upon the age of the forest and topography. The Government having the right of condemnation entered private holdings at any time and forced owners to cut infested areas. It is fortunate that the act appropriating money for the control of the chestnut blight gives this same right. We must, however, proceed with great care in condemning trees and timber so as not to arouse the opposition of the people to the work of blight eradication and the introduction of methods of management which will perpetuate best the remaining chestnut and other hard woods.

The two pests described above are unlike, of course, a fungous disease such as the blight. Insects are always more easily controlled than fungous diseases. I mention this last one to bring out especially the fact that Germany used a definite system of forest management to overcome a great devastation of the forest and that successfully.

Along the northern and western extension of the blight there should be as clean a cutting of the worst infested areas as the market will justify. The creation of a belt or zone in which there is no chestnut is, probably, not practicable in combating this disease, which is carried both by birds and insects. In localities where there are good markets for ties, mine props, acid wood, and like small products, there will be no question as to the practicability of clean-cutting over considerable areas. Where a proper market exists the possibilities of future returns under the system of coppice will be most excellent in our hard wood forests. The United States Forest Service, in a recent statement as to the possibilities of this sprout land, estimates returns as follows:

"Good quality of oak and chestnut sprout land in the Appalachians can be purchased often for less than five dollars an acre. Careful study shows that in fifty years these lands will yield seven hundred cross ties to the acre. Assuming that two cents an acre each year will pay the costs of efficient fire protection and that a cent and a quarter per acre will pay the annual taxes,

the cross ties would have to be worth, at the end of the fifty-year period required to produce them, eight and one-half cents on the stump to return five per cent. compound interest on the entire investment in land, protection and taxes. Any advance in the price of tie stumpage within the fifty-year period would mean that much profit over the percentage given."

I have referred to those returns from sprout land simply to show what can be done in the way of practicing simple coppice effectively over our hard wood forests. We can, I believe, stimulate a market for certain forest products. I know that many say we cannot help the present market conditions, but I am optimistic in this as great manufacturing concerns are stimulating the market for certain special products. Why should we not be able by showing fully the uses of chestnut stimulate its use to a greater extent than at present, at least? We must emphasize continually the utilization phases of the problem, it seems to me, in seeking methods which will accomplish the greatest good for owners of chestnut timber.

Simple coppice, which many of our Pennsylvania wood lot owners have been carrying on, in a way, for years, is without doubt the best method both for the perpetuation of the wood lots and for keeping them in such condition as to insure the chestnut being as hardy as possible against the work of the blight. That is, I believe we can accomplish a great deal by putting our chestnut forests into a more healthful condition. A tree in a healthy, rapid-growing condition, is going to be able to resist the blight and other diseases much more effectively than if it is in the condition in which too many of our wood lots and chestnut trees are at the present time. Wood lots have been run over repeatedly by fires, the humus is gone and the soil has been depleted. The trees are just hanging on, we might say, and no wonder they are susceptible to any disease that may come along. We can accomplish a great deal by methods of control that will put our chestnut forests into a better growing condition. Unfortunately, a considerable proportion of our wood lots, in which there is chestnut, have been cut very carelessly and little or no protection given the developing sprouts from either fire or grazing. There has been more or less complaint as to this method because of the gradual dying out of the mother stump. A great

deal of our cutting is done carelessly. Too high a stump is left, so that, when the sprout comes out, it is liable to be broken off by wind; whereas, if the stump had been cut low, even though it required a little more bending of the back, the sprout would be able to establish a root system of its own, and there is then almost no limit whatever to the life of the mother stump. If a high stump is left and the sprout comes up six, eight, or ten inches from the ground or further, we cannot expect anything else than the gradual dying out of the mother stump; hence a great deal can be done in properly cutting the chestnut which we want to reproduce by sprouts. Another cause for unsatisfactory results from reproduction by sprouts, and perhaps a justifiable one, in view of present markets, is the leaving of old misformed trees and forest weeds. These low-growing, half-trees are usually very tolerant and shade the sprouting stump in a way that prevents vigorous growth. A certain amount of shade is desirable, but, as a rule, in our wood lots the owner, or the contracting cutter, does not pay much attention to these weeds and leaves them. They take advantage of the space and so shade the ground or the sprouting stumps that the sprouts are not vigorous. One or two cleanings to remove these undesirable trees would make the competition for space and light much less severe and no doubt would result in better formed chestnut and oak, and the chestnut, because healthier, would be better able to resist both insects and fungi. These cleanings can be made as repeated cuttings on an exceedingly short rotation, even though the product will be of value for posts and mine props only. If, instead of this weeding out, so to speak, of blight-infested trees, here and there, we might induce the owners to use a definite system of cutting, I believe we would be accomplishing more permanent results. If instead of this destruction of scattered infested trees, which may be and probably is effective in the southeastern part of the State, on small tracts, if, in the place of this weeding out process, I say, we could induce the owners to use some such system as clear-cutting and planting with non-susceptible trees, or cutting so as to keep the forest reproducing rapidly by sprouts, I believe we would accomplish very much more for forestry in Pennsylvania. If we could in some way bring about such market conditions as to justify clear-cutting

and repeated clear-cuttings until the blight has disappeared, might we not only get rid of the blight, but in the process bring about the introduction of definite forestry practice?

I am not condemning entirely the method of eliminating blight infested trees. That method may be used more successfully over small areas of woodland such as occur in the southeastern part of the State. When one thinks of the tremendous areas of woodland which the State owns and is owned privately for instance, through Centre county and on up into Clinton county, the proposition of going in and cutting out infested trees is a hard one to consider. If over such lands we can bring about the introduction of some method of cutting on as short a rotation as possible, and as often as the returns will justify it, it is easy to see that we will keep the forest growing rapidly and healthfully and that we will do more toward keeping the blight out and perpetuating the chestnut than going here and there through that great area and cutting out infested trees. While this Commission, which is doing such a splendid work, and work which will always redound to the credit of Pennsylvania, is eliminating infested trees here and there through the State, might it not be able also to introduce a system of management among our woodland and forest owners which will continue beyond the life of the Commission? At the present time, by the practice of eliminating diseased trees you are getting rid of those infested trees only. In saying this I am not discountenancing or underestimating the tremendous educational value of the work which the Commission is doing, but if you carry on this method of eliminating individual trees only, what have you done for the owner after you get through with it? You may have stopped temporarily the blight, but if at the same time you can introduce a system of management that is going to put the whole wood lot into better growing condition, I say you are going to accomplish more in the way of permanent results and more in a forestry way in this country. (Applause).

THE CHAIRMAN: The next paper is entitled "The Chestnut Blight and Constructive Conservation," by Dr. J. Russell Smith, of the University of Pennsylvania.

THE CHESTNUT BLIGHT AND CONSTRUCTIVE CONSERVATION.

By DR. RUSSELL SMITH, OF THE WHARTON SCHOOL, UNIVERSITY OF PENNSYLVANIA.

"A horse, a horse, my kingdom for a horse!" In these words Shakespeare makes the defeated King Richard III express the value of a certain piece of property, as he paced the field of defeat, seeking flight,—not what the horse would actually cost in the horse market; not what he would bring in the horse market, was the basis of valuation, but what was going to happen to Richard III if he had to go without him.

On that basis I question if the estimates of the value of the chestnut species have been placed anywhere near high enough. The United States, with a big timber cut, is within from one to three decades of an era of timber scarcity which will put us in the position of having to go *raise* timber, rather than go *find* timber. In the timber-raising epoch the chestnut comes to the front. Taken altogether it is for the next sixty years of this nation a tree without a peer, for no other tree can touch it for all-around efficiency.

1. It grows rapidly. No other good tree of the forest can equal it in the speed with which it makes wood. By the time the white oak acorn makes a baseball bat the chestnut stump has made a railroad tie. Cut it down and it throws its shoots up six feet the first year and keeps them going. This astoundingly fast start, in connection with its record fast growth, makes it a forest marvel.

2. The wood of no other tree is so generally useful. It is durable in the ground as posts, a quality which makes it a standard telegraph and telephone pole, and a good railroad tie or mine prop. It is durable above ground, giving it many virtues as lumber. It is also a beautiful, prized, and much used wood for interior finish. Lastly, it is full of tannin, so that any chip, top, slab or scrap can be digested for this valuable manufacture.

If anybody thinks he is not a loser because he has not a chestnut forest all his own, he has another think coming.

(a) Do you wear shoes? If so, the chestnut interests you, because we are just beginning to make tannin for leather from the wood of the chestnut.

(b) Do you read? The pulp that remains after the tannin is gone makes paper; also a new industry just starting.

(c) Do you rent a house? Chestnut wood is one of the most satisfactory woods for finishing the plain man's house.

(d) Do you use the telephone or telegraph? Chestnut makes one of the best telegraph and telephone poles.

(e) Do you go a-trolleying? The chestnut is the tie-producing tree of the future, if we do not let the blight kill the species.

(f) Do you own a farm or a town lot? Chestnut is one of the great fence post trees of America.

Lastly in its list of virtues we should not forget its value, and especially its possibility as a producer of food for man, and sheep, goats, hogs, and possibly other livestock. Already the chestnut orchards of Europe make rough mountain sides worth one hundred and fifty dollars per acre. Compare that to American farm lands. The chestnut forests of Italy are reported to make more bushels of nuts year after year than the continuously cropped lands of Dakota and Minnesota yield in wheat. Fully one-fourth of the State of Pennsylvania, which is worthless for wheat or corn, is better fitted for chestnut culture than any other use now in sight. If we make them yield no better than the Italians do, that would give us ninety million bushels of nuts, an amount 50 per cent. greater than our wheat and corn crops combined. It would make this one of the greatest sheep and pig fattening states of the country.

The stake in maintaining the chestnut species from destruction is large. The estimate of three hundred million dollars is probably under, rather than over, the proper figure. In the absence of definite knowledge of the cure, how much are we justified in spending in uncertain efforts? The problem is one of insurance. Forty billion dollars' worth of property in the

United States was insured last year against fire, at an average rate of 1.14 per cent. or four hundred and fifty-six million dollars for fire insurance in one year.

Now ninety-nine and one-third per cent. of that property was insured against a fire that did not come. American property owners are paying over one per cent. of the value of their property to be insured against a chance of less than one in one hundred and thirty-three. Now it is pretty generally agreed here that the blight has a better than a one one hundred and thirty-third chance of winning out if we sit still. Therefore, business analogy tells us that we can at least afford to pay an average insurance rate on the risk. Don't forget that this fire has already broken out. If we raise an average insurance rate, for a fighting fund, we have about three million four hundred thousand dollars per year coming to us. Thus far the whole American nation has not spent over one per cent. even of that sum, and the blight has already destroyed nearly or quite one thousand times as much as we have spent to stop it.

If there is any such thing as constructive conservation, this chestnut blight is blowing the whistle for us to come and construct, and get about it quickly.

What Can We Do?

1. All agree that we can stop the movement of nursery stock.

2. All agree that we can go home and start careful and thorough surveys of actual conditions in our various States.

3. Every State can start scientific investigation to get more knowledge of the trouble.

4. Every State can try the cutting-out method of control, at least on small outbreaks, if not on a larger scale.

Therefore every State that has any blight needs an appropriation of ten thousand dollars to fifty thousand dollars for the season of 1912, depending on the size of the State. The Federal Government also needs a substantial appropriation. Altogether this will make but a fraction of the common sense fund that would be produced by a one per cent. insurance rate on the property involved.

There is no evidence to bring out in proof of the final efficiency of cutting as a cure. On the other hand, actual observation has

shown that when a forest fire jumps your fire line, you jump on it while it is little and stamp it out rather than let it run while you devise a theoretically sound method of attack.

We are indebted to the two gentlemen who have had the courage to come here and tell us that we didn't know. We don't know. But at least let us exert ourselves to the extent of average insurance cost. We don't know, but neither do the courageous Messrs. Stewart and Clinton. Their objections savor largely on the temperamental. For example, Professor Clinton tells us that he thinks drought and other climatic causes may be responsible. This is very reasonable, but it is astonishing that the gentleman did not bring something that was at least near-evidence. If drought is the promoting factor, there have been abundant opportunities to compare trees that were in different relations with respect to water. Connecticut, with its many infestations of blight has given great opportunity to find chestnut trees languishing for water on rocky, sandy, shaly, and otherwise very dry knolls. These could be compared with trees growing near water tables, in moist coves, below mill races, and in other moist locations. Such comparisons would be in the nature of proof for what is otherwise an entirely unproved theoretical suggestion. Mr. Stewart opposed the cutting-out plan, mentioning as evidence the fact that Metcalf and Collins had cut out an infestation and two years later the stumps showed a fungus and six trees nearby had the blight. Would it not be better to note that, after informal and experimental cutting out, *only* six trees had blight? Mr. Stewart also mentions as a cause for despair the fact that an outbreak at Fontella, Va., had been going since 1903. A Virginia report states that this outbreak has in that time spread to about an acre of woodland.

A Lesson From the San Jose Scale.

This miserable little bug with an umbrella on his back had us scared nearly to death ten years ago because he killed our fruit trees so mercilessly. Now any farmer can turn him into soap and keep his orchard clean, and the scientists are now telling us to go at the chestnut blight; only there is this difference

—a *man* can go after the scale. It takes the State, and much better, all of the States, to stop the chestnut blight, for he travels faster than the scale.

A National Scientific Campaign, or a National Standup Fight. An Example from Africa.

We have national corporations, national parties, national co-operation to make a meal even, and now we have got to make a national organization to fight a tree enemy just as we would to fight a man enemy. The problem is big, but we know how if we will.

We have a splendid example in the South African cattle plague. It swept for hundreds of miles, taking all cattle before it as frost does the flies. Then the South African Governments drew a quarantine line around it and fought it to a standstill right there. The United States should try the same with the chestnut blight.

An Example from the Peach Yellows.

The peach yellows is a disease of which we know just two things. The first is that it is a sure kill for trees, the second that it can be controlled by rigid quarantine. Before we knew the second fact, the disease had actually broken up communities, as in the Michigan peach belt, and reduced land values from one hundred dollars an acre to thirty dollars per acre. With quarantine in operation, and the disease still unknown, these same localities have more peach trees than ever and are again prosperous.

A Lesson from the Foot and Mouth Disease of Cattle in Pennsylvania.

The foot and mouth disease in this State,—which cost us the life of one of the most efficient men we have ever had, namely the brother of our Chairman, Dr. Leonard Pearson,—the foot and mouth disease, which is, practically, sure and quick death, and so contagious that a stableman can carry it miles in his clothes, broke out recently in Pennsylvania in many places. Yet this State jumped on it, and by a sharp, stiff, stand-up fight, it

was absolutely stamped out in a few weeks by the rigorous establishment of a dead line. I think this chestnut disease calls for constructive conservation of just that kind. (Applause).

THE CHAIRMAN: Last call for resolutions: All resolutions should be presented without delay at the desk.

We are now to hear reports by State Foresters. What is your pleasure in reference to the time to be assigned to this part of the programme? Do you desire to place any limit on reports? We desire, of course, to have them unlimited but, in your judgment is it necessary to place any time limit on these reports?

PROFESSOR HARSHBERGER, of Pennsylvania: I believe we have a time limit of half past eleven, and it is now within an hour of that time, so I believe we are obliged to have these reports within the next hour.

THE CHAIRMAN: In your opinion, would it be well, then, to limit the reports to say eight minutes, except by unanimous consent for more time?

PROFESSOR HARSHBERGER: I would imagine so; eight minutes with two minutes leeway, making it ten minutes in all. I make that motion: that the papers be limited to eight minutes, with two minutes allowance.

The motion was seconded and carried.

THE CHAIRMAN: The motion prevails. It can, of course, be excepted to under unanimous consent. Is the State Forester or a representative prepared to report for Maine? (No response). New Hampshire? (No response). Massachusetts?

PROFESSOR RANE; Is the idea of this report to give something along the line of work being done in the State

THE CHAIRMAN: The Chair will read the subject as stated on the programme: "Reports of State Foresters or other officials on the present extent of the bark disease; an estimate of the present and possible future losses." In answering Professor Rane's question, it would seem desirable to the Chair to discuss this subject from the standpoint of his own State, if that answers your question.

PROFESSOR RANE: Mr. Chairman and Gentlemen of the Convention: In so far as Massachusetts is concerned, we have this chestnut bark disease and we have also gone at it in what seems to us a practical way. I simply wish to give you an idea of how we are tackling the problem. In the first place, the disease was found scattered here and there. I made arrangements with Dr. Metcalf, because I considered he was the man of the hour to give us instructions and ideas, to go forward and carry out this work. Dr. Metcalf came on to Boston and we went over the whole proposition, and finally arranged to have a man come on last spring and go over the whole State. He spent the months of June, July, and August, visiting on a motorcycle all the forest sections of the State, to study the problem, and we found that the disease was far more prevalent than even Dr. Metcalf realized. Now when the report came out from Dr. Metcalf's assistant, the first idea he conveyed to us was that the State of Massachusetts should call upon its Legislature for a large sum of money. Most of you know undoubtedly that we have been tackling the gypsy and browntail moth problems, and that these depredations, which have been pretty much confined to Massachusetts, and more recently New Hampshire and Maine have incurred much expense. Now we have been tackling problems more or less of this sort and, as State Forester, I certainly did not wish to make the mistake of plunging into this chestnut disease problem before I was sufficiently familiar with it. We have a pretty thorough organization in Massachusetts from the forestry management standpoint, and of the papers and discussions that have come up here, the one that pleased me perhaps most was the talk that was given by Professor Baker of the State College. Gentlemen, it seems to me that in spite of the question of our needs for plant mycologists and specialists, that the necessary thing is to get further at the root of the trouble, and that is to introduce a better organization in this present development of our forest states and nation, a more definite forestry management from a fundamental standpoint. The whole problem, it strikes me, of insect and fungus depredations, is one of looking at it and studying it from the broader viewpoint, namely that of the system of forestry management. We have had the gypsy and browntail moth work in Massachusetts, more or less

similar in a general way, to this chestnut disease. We are spending in Masachusetts practically a million dollars every year on these insects. Furthermore, if Massachusetts had not taken hold of this problem as it did, undoubtedly these moths would have been into Pennsylvania by this time. But we have taken hold of it and we have methods and we understand more about this problem than we possibly could without this large appropriation. The business-like way in which the State took hold of it has commended itself. The State of Massachusetts is greatly interested as we have been discussing the pro and con as to means and ideas with regard to this blight disease. It is the same thing, going through the same thing only of another kind that the gypsy moth fight in Massachusetts has been. Even some of the best entomologists of the country seemed to think originally that the attempt to destroy the moths was money thrown away, but the people living in the infested country have appreciated the importance of it and we realize to-day that the money has been well spent. We have spent practically seven millions of dollars on these insects. On this chestnut blight disease, therefore, we do not care to go to a big expenditure in Massachusetts. What I have done thus far with this chestnut disease is to endeavor to systematize the work and carry it out along the same line that we are carrying out our gypsy and browntail moth depredation work and our general forestry work. Forest fires have been mentioned. The economic importance of putting a stop to forest fires came along after the moths came. One thing has evolved into another. At the present time I veritably believe that in certain sections of Massachusetts the gypsy moth has been a blessing to those sections. Why? Because formerly there was no system of forestry management and little forest education developed. We have gone in, cleaned up stumps, dead wood and debris, selected better species of various trees, that are now protected, and in twenty to twenty-five years I veritably believe the product will pay for all the expenses we have been to up to the present time.

Now this question of the blight disease again: As I have looked upon it,—my observations may not be very keen,—but as I have looked upon it in my own mind, we find it where the conditions are unbalanced. That is here appears to be the worst condition

we have. I was out with a man owning seven thousand acres in the western part of the State last Friday. The disease was the worst where thinnings had been made and a few trees allowed to stand because they were not large enough to cut into ties. These forests were unbalanced and the air and sun allowed to get in. The blight was on the southern side; the cankers showed up largely there. But in the stands where we had normal conditions, we found only a diseased tree once in awhile. There is an unbalancing condition again where forest fires have raged through the State year after year and the trees are abnormal and only half alive anyway. There you find the disease seems to travel more rapidly than it does where the trees are under normal conditions and have a forest floor where there is plenty of moisture and the conditions are more favorable. I have gone over it with some of our best practical men, lumber men, and they seem to think that it is a problem that is going to solve itself. They are good, practical men; they have been in the business a great many years, and are reluctant to believe that we will lose all our chestnuts. The way that we are endeavoring to solve this problem in Massachusetts is this: I have a forest warden in each town, who is appointed by the officials of the town, subject to the approval of the State Forester. I am endeavoring to educate these men so that they will know this disease. We have notified all of our papers throughout the State that it is up to the people that own chestnut trees that they become familiar with the disease; otherwise they are likely to lose their chestnut stand. We are sending out literature. We have just sent out a recent bulletin. The idea of the bulletin was to show photographs so that a man could take the bulletin and go out and determine whether the disease is present or not. We send men from the office, at the expense of the State, to assist anybody in cutting out, at the same time giving them ideas as to better forestry management; and with that the idea of education, endeavoring to make the work self-sustaining, so that the people will attend to it themselves and without necessitating State expense. I believe the first law is preservation, self-preservation, and I believe we ought to educate, ought to put out more practical publications that people will read. If boiled right down to the essence of the work, farmers will look

after their own trees, and I think forestry management will ultimately solve the problem as much as anything. There are lots of ideas that I would like to suggest; for instance, the comparative conditions as between insects and fungous diseases. We have had a great time in handling the gypsy moth; but in their case we can see the egg clusters, while, when you come down to a fungous disease, it is quite another proposition and a proposition also that it seems to me we cannot begin to fathom so quickly as one can in the handling of the insect. (Applause).

THE CHAIRMAN: Does anyone wish to ask one short question of Professor Rane?

PROFESSOR CLINTON: I understand when they began the work in Massachusetts, they were going to locate the disease and cut it all out, and that Professor Rane had the authority to send men into private woodlands of the farmers of the State and destroy those trees, if he saw fit. He has not done that. Why?

PROFESSOR RANE: As for the question of cutting out the chestnut tree, that was our plan when Dr. Metcalf sent his man in, and we went all over it. I selected one of our best woodchoppers and he was to follow along and wherever the expert found a tree,—we expected to find one in about every other county in Massachusetts,—he was going to cut it out. This fellow started out with an axe, and when we came to some old trees that were about ten feet in circumference, and there was some question as to whether the disease was there or not, but they thought they had better cut it out anyway, this man did not feel as if he was equal to the occasion. It was practically impossible to do anything along those lines and the trouble was that, even among the experts, there was quite a discussion as to whether the disease was prevalent or not. It is an impossible problem to cut out under our conditions. The forestry management end of handling the wood lot, and taking it out where you can, I think is the practical solution.

THE CHAIRMAN: Connecticut.

PROFESSOR CLINTON: We have no appropriation in Connecticut to fight this trouble or to stop it. We have merely

carried on our investigations with the usual appropriations of our State. We are asking for no special fund.

I have a paper which I desire to present, and I want to state that it is signed not only by myself as botanist, but also by Mr. Spring, State Forester:

CHESTNUT BLIGHT SITUATION IN CONNECTICUT.

First Reports.

The first specimens of chestnut blight from Connecticut were sent to the Experiment Station in November, 1907, by F. V. Stevens of Stamford, who had found the disease doing considerable damage in his region during that summer. He also stated that he thought he had seen the disease in one or two other towns in the state. Since that report, others have stated to us that they had seen the disease earlier, but had not known its nature at the time. For example, Mr. G. H. Hollister, who is here today, states that in the summer of 1905 he found a tree on the Edgewood Park Estate at Greenwich that he now believes to have had the blight. Our forester reports that a farmer in the town of Easton also noticed the disease as early as 1905. These three towns are all in Fairfield county, next to New York State. In the winter of 1909, Mr. Newton J. Peck brought a specimen to the Station from Woodbridge, New Haven County, and stated that he had noticed the disease in his forest for four or five years. So far, then, we have no information of the presence of the disease in Connecticut before 1905.

Subsequent Reports.

In the report of the Connecticut Experiment Station for 1908, we noted the disease in twenty-two of the twenty-three towns of Fairfield County, in eight towns of New Haven County, and we had an unverified report of its occurrence in New London County, in the eastern part of the State, making thirty-one towns in all.

In the Station report for 1909-10, we listed the disease from all the twenty-three towns of Fairfield County, twenty-one towns of New Haven County, fourteen of Litchfield, seven of Hartford, two of Middlesex, three of Tolland, one of Windham and one of New London County. Thus we found the disease present

in all of the counties of the State, and in seventy-two of the towns. Of these only seven towns were east of the Connecticut River, but this region had not been carefully examined. At the Albany conference, held October 19, 1911, we reported the disease present in one hundred and twenty towns of the State. To-day (February, 1912) we have records of its presence in 164 of the 168 towns of the State (all but Ashford, Eastford, Putnam and Haddam), and we have every reason to believe that a careful search would reveal its presence in these four towns.

Present Situation.

The present situation in Connecticut, then, is that we have the disease in more or less abundance in practically every town. We are surrounded on three sides by states that have the disease more or less abundant in their different counties. On the south, we are separated by Long Island Sound from Long Island, which also has the disease.

In Fairfield County as early as 1907, the disease was doing considerable harm, and by 1909 it was very serious, while to-day, from fifty to seventy-five per cent. of all the chestnuts are affected or dead. New Haven County began to show evidence of trouble in 1908, and at present the disease is present in most of the forests and serious in many of them. Litchfield County did not begin to show the trouble until 1909 and 1910, but last year it was doing considerable damage there. Hartford and Middlesex counties also last year began to show its presence in their forests, in some places very prominently. These counties are all west of the Connecticut River. East of the river the trouble is not nearly so general or abundant, but in some places in 1911 it was causing considerable damage.

The year 1911 more than any other seemed to be favorable for the spread and injurious effects of the fungus. This we attribute to the unusual drought of that year, lasting from early spring until the last of July. This is the fifth and most severe of a series of drought years that we have had since 1907.

Control Work.

Our work in the field, besides locating the disease, has been along the following lines:

(1) Studying the progress of the disease on marked trees.

(2). Setting out seedling chestnuts, including a few cultivated varieties, in infested forests, to see how the disease will affect them.

(3). Attempting control in a badly diseased private forest by the cutting out method. This did not prove of value, and after two seasons we have discontinued the work. Opening up the forest there seemed harmful to the chestnuts left, especially on south and west exposures.

(4). Attempting control by the cutting out method in a state forest where the disease was not conspicuous. This work has just been started in our forest at Portland. Previous to 1911, only a few diseased trees had been seen in this forest. Our preliminary survey this winter, however, has shown it now present more abundantly than we expected. On account of the time it took to locate the diseased trees and the labor and cost of cutting them out, we cannot advocate this as a practical method for general use in the State, even if it proves successful, which we doubt, since the disease is generally present in the neighborhood.

Recommendations.

In Connecticut we are not asking the legislature for any special appropriation to fight this disease, and do not expect to. We are taking no concerted action to control it and we do not think this feasible. We are only occasionally advising cutting out, when the disease first appears, as a possible, though not a proved method of control. Where a wood lot as a whole is merchantable, and the disease is present, we advocate that, if market conditions are favorable, it be cut and disposed of in the ordinary way. Where the trees are not as a whole of marketable size, and the disease is present, we advocate the removal of the dying trees, and their disposal as poles, ties or cordwood, as their size may permit. We have no uniform recommendations for treatment of sprout growth too small for market purposes. We are trying to prevent a glut of the market by discouraging wholesale cutting of the forests, and as yet we have noticed no general glut and drop of prices except for cordwood in certain towns, and for 7 x 9 ties, for which the demand on the part of

the railroads has evidently gone down. On the whole, however, there has been more timber cut than usual. We have no small factories for the utilization of waste products, such as bark and wood for tannin. The brass factories and the brick kilns use up most of the chestnut cordwood in their vicinities, thus preventing much of a glut. Lime kilns also utilize considerable of the cordwood. A relatively small amount is made into charcoal.

THE CHAIRMAN: Are there any questions for Professor Clinton?

MR. CHESTER E. CHILD: I would like to ask Professor Clinton what was the result of the cutting out of the infected trees on any tracts or estates he knows about; where the affected trees were removed, what was the result on the trees that remained?

PROFESSOR CLINTON: That was on the estate of one of the wealthiest men in Connecticut, so he had money enough to cut them out if he wanted to. It was on the southern exposure of a hill and we found that, where cut out, the trees left seemed to suffer more from drought, etc., and be more injured by blight. We also found that by cutting out the trees and not removing the bark from the stumps, about thirty per cent. of those stumps showed the disease present on the bark that was left. Up to last summer the forests in the same region, on the northern exposure, had not suffered much from blight. This gentleman said that he would go on if we wanted to continue the experiment, but he thought, as far as he was concerned, in the future he would prefer to cut the trees as they died. That was not a thorough, careful experiment like they are going to conduct here in Pennsylvania, by cutting every diseased tree down and burning the bark and all that, but it was about the way a practical man would do it.

THE CHAIRMAN: There is time for one more question, if anyone desires to ask one.

MR. THALHEIMER: Have you found out whether the conditions differ between low and high ground and the exposure, on

the southern, northern, or eastern and western sides; that is, whether you found any infected trees on the eastern side of the mountain?

PROFESSOR CLINTON: It shows most frequently on the eastern and southern side and around to the western and southern side of exposed trees. That is, the more northern slopes are generally less affected, in our experience. Examine the chestnut trees in Fairmount Park in Philadelphia, and see if the blight does not come out more on the western and southern side. Look at your trees and see if you do not see injuries on that exposure, that is, before the trouble becomes general.

THE CHAIRMAN: New York State.

MR. G. L. BARRUS, of the Conservation Commission: Mr. Chairman: First of all, I want to say that the commissioners and Superintendent Pettis hoped to be here for this Conference, but were unavoidably kept away, and I regret to say that we have not any definite statistics to give as to the value of the chestnut or the amount that has been destroyed. I think this question has brought up the need of such statistics; if it has not done anything more, it has brought up that need. We have been confining our efforts in New York, been confining this forest policy to sixteen counties, which include the Adirondacks and Catskills. About six million acres of forest land are included in that area. Outside of that, there is another six million acres of farm wood-lot land ,which has had little thought in the past as regards forest management. This question of chestnut bark disease has brought our attention to this other six million acres of land. If it has not done anything more, it has done that, and we are now concerned in finding some way of branching out, taking care of and giving management to this portion of the forest land of the State.

As to the distribution of the chestnut, I might say that we sent about four thousand circular letters throughout the State, asking if the chestnut was found in the towns where these different persons resided, and asking if the chestnut bark disease was present. The public showed their active interest in the subject in the way they replied. We got over a thousand answers to those letters, from all parts of the State, and in that way we are

enabled to give a rough map of the state, showing where the chestnut is found and, to a certain degree, where the chestnut disease is found.

We find that the chestnut belt of New York State covers forty-six per cent. of the total area of the State (approximately 23,000 square miles), and on that area I think it is conservative to say there are thirty million dollars worth of chestnut timber. The diseased area, or I might say the chestnut belt, includes the Hudson Valley and the southern part of the western half of the State. The Adirondack region has no chestnut, and the same may be said of the Catskill region. The diseased area is confined primarily to the Hudson Valley, and includes one-quarter to one-third of the chestnut belt. West of the Catskills, the chestnut bark disease has been found in one case in Tioga County, on the Pennsylvania line; one case in Broome County, near the Pennsylvania line, and in two or three cases, in Delaware County; a matter of from one to twenty trees in a batch. That is the best information we have at the present time.

The loss due to the chestnut bark disease cannot be estimated, inasmuch as we have not had the time and the money to put men in the field in that portion of the district. We have confined our attention to the outlying districts where the disease was spreading, and I dare say there is at least ten million dollars worth of timber that is already destroyed, or will be destroyed before it can be utilized. The problem of utilization is a big one in New York State and, in order to do something in this way, several conferences have been held in connection with the Eastern Foresters' Association, and it was found that little could be done to develop new markets for the chestnut. The leather market and the tannic acid market seem to be flooded, and in such a condition that it would not encourage any new industries in the tannic acid business in New York State, the tannic acid plants preferring the southern chestnut in most cases rather than the New York chestnut. I do not think that the chestnut is so much of a glut on the market at the present time that it is necessary that New York State people should cut out their trees and sell at a sacrifice. The poles have been taken

out gradually, and that market is not flooded at the present time. There is also a good market for cordwood in most portions of the State.

I just want to say one other thing in regard to Professor Clinton's attitude toward this question: It seems to me that it is an encouraging fact, if the points he has brought out are found to be true; I think it is a most encouraging statement; I think that if favorable weather conditions are going to help to bring the chestnut back to increased vitality, so that it may be able to resist this disease, I think it should encourage us to eliminate as much of the infectious material as we can at the present time, and thus aid nature in anything she can do to restore the chestnut to vitality. In New York State we have had several articles in the newspapers, bringing this subject before the people. We have gone about the work of finding out where our chestnut stands are, and have had the wood-lot sections, as I say, outside of the previously reported preserved area, brought to our attention. It occurs to me, who should get the credit for bringing out these points? Who should get the credit for this Conference here to-day? Who should get the credit for calling several conferences relative to the utilization of the chestnut, and were those conferences worth while? It seems to me that it should be given to the men who were willing to stake their scientific reputations on something that could be tried, rather than to give it to the men who were afraid to stake their scientific reputations, and who say, "It cannot be done." (Applause).

THE CHAIRMAN: Is there any inquiry regarding the New York situation and methods?

MR. J. W. FISHER, of Tennessee: I would like to know what per cent. of old timber, as against young timber, is infected by this disease; whether or not the young timber is the principal timber that is infected.

MR. BARRUS: In those sections of New York State where the chestnut disease is present, most of the marketable timber has been cut out, fire has gone through the remainder, and, as the result, there is a great majority of the chestnut which is sprout growth of small dimensions. I should estimate that

one-fifth of the chestnut is of merchantable size and perhaps, in the district where the disease is, more than four-fifths is under merchantable size.

MR. FISHER: Does it not appear that the several years of scant rainfall which the whole eastern country has endured, together with frequent fires in this young timber, is not this possibly one of the greatest sources of the disease?

MR. BARRUS: I believe that is a question touching on the technical and scientific side, and perhaps Professor Clinton——

THE CHAIRMAN: As we are confined to State reports now, we will ask Mr. Fisher kindly to let that question go until we get into general discussion. The next is the State of New Jersey.

DR. MELVILLE T. COOK: Mr. Chairman. I regret that the State Forester of New Jersey is not present. I have been in the State only a short time, and so cannot speak first hand. However, as most of you know, the State of New Jersey, being close to that point where the disease is supposed to have originated in this country, has suffered probably more than any other State, in proportion to its area and the amount of standing chestnut. The disease has swept through the State (excepting the southern part), and has proved extremely destructive. We have no special appropriation for the study of the disease or for fighting it, and I believe that you will all agree with me that such a campaign as is being carried on in the State of Pennsylvania would be absolutely impossible in the State of New Jersey at the present time. We are, however, continuing our scientific investigation, so far as possible, and wherever we receive inquiries from farmers who are timber owners, reporting the disease present on their properties, we advise them to turn their chestnut into cash as quickly as possible, and to clean up as thoroughly as possible. We also advise persons contemplating planting chestnut not to do so. We also advise the nurserymen to discontinue handling chestnut stock at the present time. So far as possible, we are stimulating the market by advising builders to use the chestnut for interior trimmings.

I cannot say anything more in regard to our campaign in New Jersey. However, I wish to give just one or two observa-

tions which I have made upon this disease: So far I have been unable to confirm the observations of Dr. Clinton in regard to the weather conditions. His observations may be absolutely correct, so far as the State of Connecticut is concerned, but in the territory which I have examined it has been impossible to confirm them. I have on two occasions, found the disease in dense timber on the sprouts, down under the heavy, large growth, when it was impossible to find it in the tops of the trees or at any point near the one on the ground line. I do not know how much that observation will be worth to you, but undoubtedly the surrounding trees in the vicinity were not so infected as to make it noticeable in walking through the timber and making careful observations. The only points where we could find the disease at all were close to the ground, and the sprouts there were badly infected.

THE CHAIRMAN: We will now hear from the State of Pennsylvania. We will call on Deputy Forestry Commissioner I. C. Williams.

MR. WILLIAMS: In speaking for Pennsylvania, I think probably the subject has been well covered and that I should say little. I want to say something, however, about the appearance of the blight in the forest reserves. The Pennsylvania forest reserves to-day are included within twenty-six different counties and aggregate nine hundred and seventy-two thousand acres. The line of reserves on the west approximately follows the dark line on the map, extending somewhat west of it on the north. Beginning with Potter county, which is at the middle of the northern line, and dropping a line southwestwardly to western Clearfield and then southwardly to eastern Westmoreland, you will include east of such a line all the forest reserve counties. The chestnut blight has appeared in the forest reserves equally as it has appeared on private tracts. In the westernmost reserves, the foresters and other officers are busily at work seeking it out and destroying every infected tree they find. The Pennsylvania Department of Forestry proposes to take no chances in leaving an infected tree stand, out toward the west. That tree comes down. If we can sell it, well and good; if not, it is converted into ashes to fertilize the ground. That is a method that I think we shall continue to pursue.

I would like to say a word further with respect to the cutting-out method. We have heard considerable in this series of meetings about the importance of our doing things. Whenever I hear a man talking about "impossibilities," then something begins to boil. I do not believe in "impossibilities" that are simply guessed at. It was no impossibility for the Pennsylvania lumbermen to sweep over this State from the Delaware to Ohio and take down every merchantable tree within the State; and that has been so completely done that Pennsylvania has figuratively been combed of her merchantable forest trees. If it is not impossible to do a thing when there is a money reward behind it, why is it impossible to do it when there is simply some altruistic thing behind it? This method of dealing in impossibilities is mighty misleading business, and I want you to know that we believe it is so. The cutting-out of this diseased stuff in the forest reserves, then, is going to continue. We propose to find a market for it if we can; but if we cannot, it is going to be destroyed. To that extent the Department will contribute its small share to do what it can, to stop the westward advance of this scourge.

Let us not talk about impossibilities until we know we are up blank against the stone wall. You have well gathered from the uncertainty which has pervaded these meetings with respect to methods and means, that it ought not to lie in the mouth of anybody to come here and talk about impossibilities, especially with regard to things that are not half way investigated. Let us investigate and work: not investigate first and work afterwards. Let us get busy all along the line and, when we have utterly tried out every method and are absolutely and abjectly defeated, then it is time to talk about impossibilities. (Applause).

THE CHAIRMAN: Is there any inquiry?

PROFESSOR SMITH: I should like to repeat the question of Mr. J. W. Fisher, because I believe Mr. Williams is in position to throw some light on it. We have had a great deal of trouble with fat lands near Philadelphia, on the lands of rich men, where forest fires are unknown. What has been the testimony there with regard to this climatic matter?

MR. WILLIAMS: I happened to be in charge of that Main Line investigation, and probably know something about it. We found there all conditions of forest growth. We found that mature forest giants, running up in diameter anywhere from five to seven feet, and we found the tiny sprout coming out of the stump. We found the infection attacking trees of all sizes. It seemed not to prefer any particular age or size of tree. I have in mind to-day a splendid old tree belonging to a gentleman living near Philadelphia, that was worked on by a tree doctor. He punched it full of holes with his climbing spurs, and in a few months afterwards that tree was infected from top to bottom in those punctures. That was a tree, the owner told me for which he would not take a thousand dollars if it were possible to save it. In working on a tract to the north of Philadelphia, near Jenkintown, we found large timber prevailing in the area. There were some three hundred and forty trees in the tract. The trees probably averaged over a foot in diameter. We found that in the top of the largest trees there was occasionally a single dead branch, and that always, of course, excited attention; but the minute investigation that was made of the tree was at the ground line, about the trunk; and almost invariably, in those big trees, when we found any suggestion of infection in the top, we found pustules nearly at the ground line, and it made no difference what the size of the tree was. We likewise found sprouts no thicker than a straw badly infected, and from that size up to the giant forest tree. Frequently we found pustules at the base of large trees, but were unable to find anything in the crown of the tree. With the strongest spyglasses which we carried with us, we could pick out nothing; but getting down on our knees and going around the base with a hand magnifier, almost invariably, where the disease was in the neighborhood, we would find a pustule or two on the base of the tree, and of course that classed it as infected. I take it that this disease shows no preference in trees, and, while it is probably true that it will attack somewhat more readily the young, sappy sprout growth and kill it much more quickly, it is equally certain to do its work with the older trees.

THE CHAIRMAN: Does that answer the question, Mr. Fisher?

MR. FISHER: Yes, sir.

DR. J. M. BACKENSTOE, of Pennsylvania: Mr. Chairman: I would like to ask the speaker with reference to the treatment that was given to these thousand dollar trees.

MR. WILLIAMS: We came in contact with a good many interesting propositions down there, and we were visited by tree doctors from the day we arrived until the day we left. When we went in they implored us, and when we went out they cursed us. One of the methods of treatment was that they would prune off every infected piece of bark or branch, and cover the wound with some dressing. But in the process of doing this work, they used telephone linemen's climbers. This they thought was the proper thing, so they did it. We discouraged that and finally broke it up. We did not think that method of treatment was good. Then we were met with the idea of throwing some chemical on the ground, in order that when the rains would dissolve this material, it would enter the soil and be taken up by the roots. Generally, we were met with a proposition to buy some of the material and try it ourselves. It was most infrequent that we found these things were being tried by the people who recommended them. Then there was the idea of introducing into the sap of the tree some medication. There was another idea, with respect to watering the tree. The plan advocated by gentlemen engaged in the business was, that they would take a large chestnut tree, say three feet in diameter, and after some examination conclude, just empirically, that it was suffering because of lack of water. That may have been entirely true; but the method of treatment was to run down a series of two-foot lengths of two-inch gas pipes, or one-inch pipes, as the case might be, at a short distance from the trunk of the tree, and then turn a hose into the pipes and moisten the ground. I believe if those pipes had been put down at the proper place, good results might have followed. Water might have been introduced into the feeding roots of the tree. But it is of little value to introduce water under the tree near the trunk, where there is little absorption from the ground. There were other methods of treatment advocated. I do not remember them all now, but they have been tried out there pretty generously. Men who are

owners of trees of that character, wishing to preserve them if possible, have paid large sums of money to allow treatment to be applied, but I do not know of any instance yet where it may be said that any particular treatment has been a complete success. Occasionally, and very frequently of late, we have been reading about methods of treatment in the newspapers, where men say they have just the thing. For instance, we had a letter the other day from a gentleman in northern Ohio. He said he had a preparation that would kill the chestnut blight and he wanted us to buy it right off. Now, there is no chestnut blight in Ohio, and I take it that this man had never seen a blighted tree and does not know what the chestnut blight is; yet there he has the remedy all prepared. Much of this remedial business is just of that character. I believe also there is an opportunity to try out a lot of remedies and get some results, but there are no results of value to be had from jumping at conclusions and saying "This thing will do the work," or that thing, until we know it actually has done it. Therefore, the Commission is giving all reasonable latitude to these gentlemen who have anything of the kind to offer, and every opportunity to try out their methods, in the hope that something will be found that will do some good. That is part of the Pennsylvania proposition, to let nothing be untried, even if it does not produce results.

THE CHAIRMAN: If that does not fully answer Mr. Backenstoe's question, we will ask him to bring it up later. The question was with reference to the treatment of thousand dollar trees.

MR. WILLIAMS: All trees down there are thousand dollar trees.

THE CHAIRMAN: Delaware.

PROFESSOR C. A. McCUE: The chestnut grows naturally in the two northern counties of Delaware. It is found in the southern county only here and there, and mostly in plantations. The disease is common over the entire State. While I do not say that it would be impossible to quarantine against this disease in the State of Delaware, I do say that, considering the way we have the disease now, it would not be a good proposition in the State. I am not in favor of the State of Delaware ap-

propriating any public money for methods of eradication of this particular disease. I think the disease is scattered too generally throughout the State. We have no need of a quarantine line on the east, because we have the Delaware River and the ocean, nor on the west because our friends over in Maryland already have the disease. The Chesapeake Bay does not seem to have stopped it on the west. I think our solution of the problem, if we have any, lies in the question of management, and I am rather loath to believe that even the chestnut is entirely doomed in the State of Delaware, even where the infection is as general as it is, as I believe,—I am optimistic in the matter,—that with proper management, brought about with proper educational propaganda, we will be growing chestnuts in some manner, a great many years hence. We have many chestnut plantations in our State. We are not advising our growers to plant chestnuts for nut culture, neither are we advising the planting of chestnut trees in our forests. But we believe that, by cutting out diseased trees, especially the larger trees, as soon as their usefulness passes, and putting them upon the market,—that is, when the annual increment falls down below the amount of damage done annually by the disease,—that in this way, the disease may be gradually eliminated, to such an extent, that in certain localities, finally all the diseased chestnut trees will have been taken out, I believe, that there will still be left a number of chestnut trees that have never taken the disease. By proper management and by encouraging people to take out trees as they become diseased, I believe that in years hence, we will still find a great many chestnut trees growing in our Delaware forests.

There is another point regarding infection, which I have not heard spoken of here, that has come under my observation. I have noticed that where hunters are allowed in young coppice growth that a great many of the young sprouts are injured by the shot, and that in areas infected by the chestnut disease that every shot hole offers a point of entrance for the disease. Hunters should not be allowed in young chestnut coppice.

Having, as we do in Delaware, a number of chestnut orchards, it throws a rather interesting light upon the question of drought as a predisposing cause of the chestnut disease. Those orchards are under cultivation the same as our apple orchards. They

are not suffering from drought, neither are they suffering from a scanty food supply. They are in good, thrifty condition. We find that practically every chestnut orchard in the State is infected with the chestnut disease. In Delaware, at least, I am not inclined to believe that drought plays any part whatever in the chestnut disease problem.

THE CHAIRMAN: Is there any question?

PROFESSOR NORTON: I would like to ask if the blight is equally bad on the Japanese chestnuts?

PROFESSOR McCUE: It would be rather hard to answer that question definitely, because I do not know whether we have any simon-pure Japanese chestnuts in Delaware or not. We have a lot of varieties called Japanese, but the probabilities are they are natural hybrids with the American; yet we have found infection in the so-called Japanese chestnuts the same as in the American.

MR. WILLIAMS: What is Delaware doing to prevent the shipment of infected stock beyond the borders of the State?

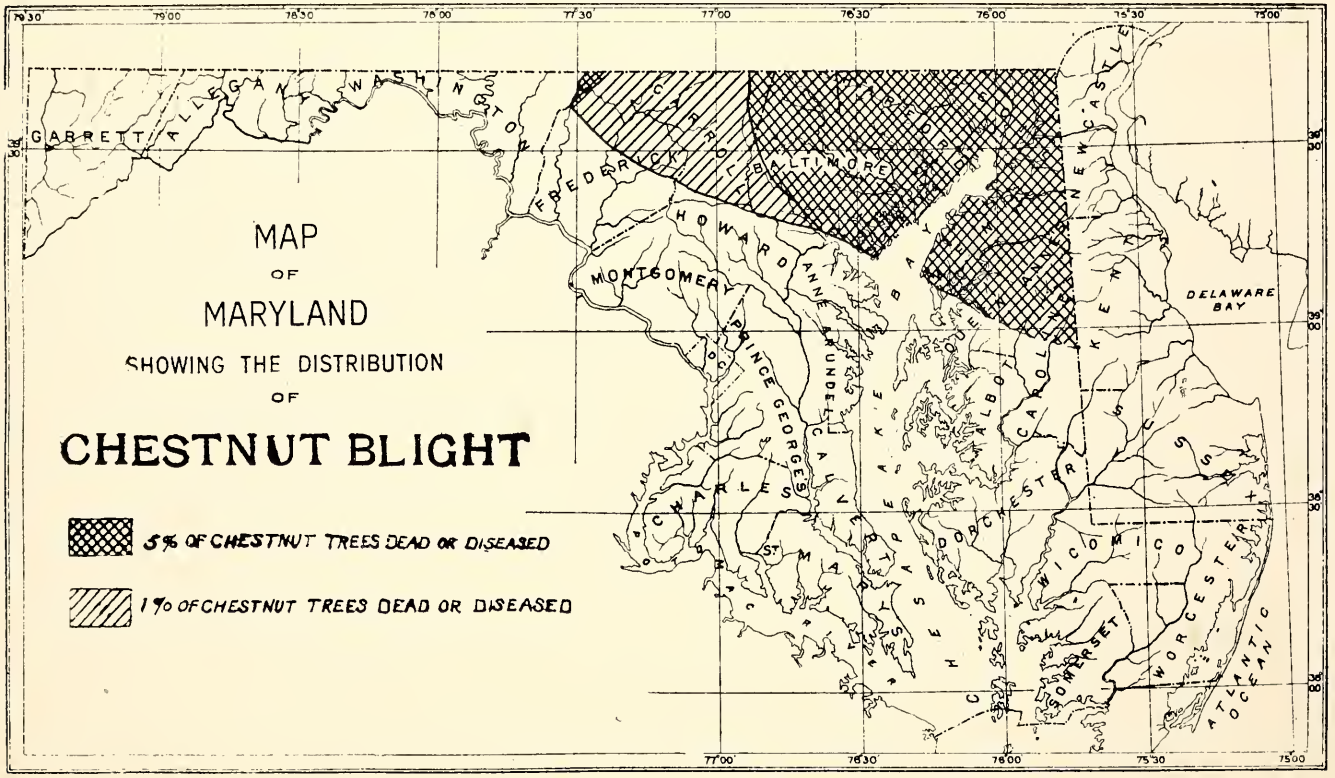
PROFESSOR McCUE: With the permission of the Chair, I will refer that question to the secretary of the State Board of Agriculture, Professor Webb, who has charge of the nursery inspection work of the State.

THE CHAIRMAN: Professor Webb, will you please inform us what Delaware is doing to prevent the shipment of infected nursery stock beyond the borders of the State.

PROFESSOR WEBB: I believe at the present time we have no nurseries growing chestnut trees, but, if diseased chestnut were found in them, the trees would be destroyed.

THE CHAIRMAN: Maryland. As one of the secretaries of the Conference, we have present Maryland's State Forester, Mr. F. W. Besley.

MR. BESLEY: As far as the chestnut bark disease is concerned, I think all eyes are on Pennsylvania. Pennsylvania has established, as it were, a great experiment station for the treatment of the chestnut bark disease, and we are all looking with


MAP
OF
MARYLAND
SHOWING THE DISTRIBUTION
OF
CHESTNUT BLIGHT
5% OF CHESTNUT TREES DEAD OR DISEASED
1% OF CHESTNUT TREES DEAD OR DISEASED
GARRETT
ALLEGANY
WASHINGTON
FREDERICK
CARROLL
BALTIMORE
HARFORD
CECIL
HOWARD
MONTGOMERY
PRINCE GEORGES
ANNE ARUNDEL
CHARLES
ST. MARYS
CALVERT
QUEEN ANNES
KENT
DELAWARE
TALBOT
CAROLINE
DORCHESTER
WICOMICO
SOMERSET
WORCESTER
DELAWARE BAY
ATLANTIC OCEAN
CHESAPEAKE BAY
79°30
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a great deal of interest to the results which may be accomplished through this work. I came up here for the purpose of listening. I want to hear what has been done. I hoped that we might have some definite cases where the chestnut bark disease had been eradicated from specific spots. It should be remembered at this time that, Pennsylvania has only taken it up recently. There has been less than a year's operation of the new law and of course, we cannot expect very extensive results, but it seems to me, and it has already been pointed out by a number of speakers, that there is the necessity at this time of treating individual trees and of keeping an accurate record of them, so that we will know exactly what we may expect in the way of eradicating the disease. Professor Clinton has spoken of certain diseased trees that were cut out, and he mentioned the fact that the bark was left on the stumps. We know absolutely that where the bark is left on the stump of a diseased tree, in which the spores very naturally work down the tree we are pretty apt to find them around the base; so, of course, we cannot consider that a very effective way of treating the tree, or a fair test of the cutting-out process. What we want to find out is where somebody has treated a tree, cut the tree out, then destroyed the bark, and kept a record of that for some years, two or three years, possibly, to see if there is any recurrence of the infection. I was talking with Dr. Metcalf sometime ago along that line and he says that, in the vicinity of Washington, they have for the past two or three years carried on a rather extensive campaign for the detection and eradication of the disease, and I think I am correct in the statement that he has located certain spots, cut the disease out, and there has not been a recurrence of the disease. I should much prefer to have that statement come from Dr. Metcalf, or somebody from the Bureau of Plant Industry; but, if that is the case, this Conference ought to know about it, because it seems to me there is a ray of hope there that we may be able to combat this disease. There is, of course, as shown by this Conference, a general interest in this bark disease, and I cannot help but believe that a Conference of this sort is going to lead to very productive results. The interest in Maryland is a very important one. We realize that it is necessary for us to do something *now*, if we are going to do *anything* at all. We find that the disease has spread

over the eastern and northeastern sections of the State. Perhaps one-fourth of the State has been generally invaded. Probably about five per cent. of the chestnut trees in the area is lost up to the present time, and I may say this is based on an investigation of last summer to determine the extent of the damage caused by the chestnut bark disease in Maryland. I might say also that this investigation was prompted, at least, by the very excellent example that we have in Pennsylvania, because we felt that we might use it as data, not only for the State of Maryland in trying to control the chestnut bark disease, if it is possible to do so, but for other States in co-operation with the State of Pennsylvania. We found that the amount of damage up to the present time was about thirty thousand dollars, that is, the stumpage value of the chestnut trees, and in the area of infection that the stumpage value of the chestnut was something like six hundred thousand dollars. The disease appears to be spreading very rapidly. The total stumpage value of all the chestnut in Maryland is something like two million dollars. So, if there is some way by which we can control the chestnut bark disease, it is going to mean a great deal to the forest interests of the State. What we propose to do,—and we have already started the machinery going, but the results of this Conference are going to determine very largely the manner in which we are going to press that,—we thought it might be possible, by establishing a sort of dead line just outside the area of infection to prevent the spread of the disease. Now I do not know whether that is practicable or not, but it seemed to be the only solution offered at the time, and in carrying out that idea we have introduced a bill, which is practically a copy of the Pennsylvania law, into the Legislature of Maryland, now in session, carrying a small appropriation for the purpose of putting this work into operation.

Now we have had several people speak about the management of the chestnut as being perhaps the solution of the difficulty. It seems to me that where a man has the chestnut bark disease in his woods, it would be simply commonsense business policy to cut out those diseased trees and utilize them wherever possible, and I think we can depend on the individual land owner to do that. Now whether it will be possible for us to go much further than that in recommending the prompt cutting out and utiliza-

tion, where possible, of the diseased chestnut trees, I am not prepared to say. I doubt whether it will be possible to go any farther than that, but it seems to me, outside of this area of general infection, if we can establish a sort of quarantine zone beyond which we can protect the rest of the chestnut trees in the State, that the work will be well worth while, and that is the line along which we are proceeding at the present time. Now as to the question of management, I think that simply by cutting out diseased trees and by a coppice management of the chestnut, I do not see how that is going to eliminate the disease, because we know definitely that the stumps are more apt to be diseased, and this infects the sprouts as soon as they come up. I have seen that time and time again over the State of Maryland, that those sprouts become immediately diseased, and the whole tree dies very quickly. What has been done has furnished the basis of the proposed work, and I hope that we will be able to evolve from this Conference some definite programme, which other States can adopt with some hope of ultimately controlling the chestnut bark disease. I realize that it is a very big proposition, and we are not going to do it all at once; but I think by concerted action and a definite policy, we will certainly be able to limit the destruction by this disease, which has already done such an immense amount of damage in the northern States. (Applause).

THE CHAIRMAN: Are there any questions?

MR. BRAUNBERG, of Pennsylvania: Are those approximate figures you gave of the damage already occurring in the State of Maryland to the chestnut trees? You made an approximate estimate of the damage to the chestnut trees, also an approximate estimate of the value of the chestnut trees. May I have those figures?

MR. BESLEY: The present damage was estimated at fifty thousand dollars, based on a stumpage basis, and the total stumpage value of the chestnut in Maryland is about two million dollars.

THE CHAIRMAN: Mr. Detwiler will comment on one point raised by Mr. Besley.

MR. DETWILER: Mr. Besley asked for some definite facts concerning the efficiency of the cutting-out method. I have some facts, which are not conclusive, but may be of interest. Mr. Peirce, Secretary of the Commission, cut several hundred trees on his property, near Ardmore, last year. The stumps were barked to the ground and the sprouts came up abundantly. Two weeks ago I sent one of our fields agents to investigate thoroughly, and he reported being unable to find a single sprout diseased, and those sprouts are now a year old. It may be that after two years they will be diseased, but at the present time they are still sound.

THE CHAIRMAN: Virginia.

DR. H. S. REED: Mr. Chairman: The Experiment Station has studied the chestnut blight in a small way, since we have had, up to the present time, very little complaint of diseased chestnut in the State. We have heard, though, from several here at this meeting, that there are a few centres of infection in the State. We know the disease is present just across the Potomac from Washington, and we know it is present in Bedford county, at Fontella. We have reports, however, which have not been fully verified, of the disease in Albemarle county and also in Henrico county, near Richmond. I went over the last named territory with Dr. Metcalf last fall, but we were unable to find the disease in the field. We have, however, in the State, a disease which has existed for about twenty years and has caused a very considerable destruction of chestnut timber, south and east of Lynchburg. I visited this region about ten days ago and found there a fungous disease, of which we have not yet been able to determine the exact nature. Some of the gentlemen who are here have found the *Diaporthe* fungus near Lynchburg. If the *Diaporthe* fungus has been there for the last twenty years, it is evident that it is acting somewhat differently from what it is acting in the North. We have this question under observation. The diseased areas are at present confined to the Piedmont district; none has been reported from higher elevations in the Blue Ridge or Allegheny mountains in the State. There is a bill before the Legislature now in session, asking for a small appropriation to be used against this disease, which will not per-

mit of any extensive eradication, but we hope to use it in getting a good survey of the damage which has already been done and to get a basis for future recommendations.

THE CHAIRMAN: Are there any inqurries regarding the situation and methods in Virginia? The next State is West Virginia.

PROF. GIDDINGS: I will make my remarks brief, because we have done but little in West Virginia in regard to it. So far as we actually know, there were three infections in West Virginia. Those were scattered through the State; one in the central part, one in the northern part, and one fairly well south in the State. One of them came from nursery stock. The tree was purchased from a nursery, set out by a lumber man, and he discovered that there was something wrong. That tree has been destroyed. One of the other diseased areas, in the northern part of the State, we believe has been destroyed through lumbering operations which have been going on there, as I understand the infected trees could not be found last fall. We undoubtedly have more of the disease, especially along the northern border and near the Pennsylvania line, as there is considerable infection in the southwestern portion of that State. We hope to get some work done during the coming season. I know that a number of interested parties will make a very strong effort to have at least a small amount of careful work done in West Virginia to determine the prevalence of the disease in certain sections of the State. We cannot hope to do much, but our Legislature will meet a year from now and if conditions warrant, there will, I am sure, be no trouble in securing funds to continue the work. The possible losses in West Virginia are considerable. I have secured several estimates as to the chestnut stand in the State. One firm which is reported as doing the largest lumbering business in the State, dealing in timber land and well acquainted with the subject, places the present stumpage at ten billion feet. As proof and in support of their statement, they gave me reliable data in regard to the chestnut stand in some regions of the State. A stumpage value of $2.50 per thousand, which they quoted, would make twenty-five million dollars for the chestnut

in West Virginia, and certainly some effort will be made to determine the extent of infection and the best methods of handling the disease in the State.

MR. BESLEY, (acting temporarily as Chairman): Are there any questions to be asked Professor Giddings? The next is Ohio; is there anyone to represent the State of Ohio? (No response).

North Carolina. Is there anyone to speak for North Carolina? (No response).

We will next hear from Tennessee.

MR. J. W. FISHER: Mr. Chairman: As far as I know, there is no infection in Tennessee. We are extremely interested in the matter, because we have such a vast area of chestnut forest, and a very large amount of it is the original forest. We have very far-sighted Congressmen down our way, who have been fortifying, or are about to fortify, us against such infection, by having a bill passed through Congress appropriating one million dollars, to establish forest reserves in western North Carolina and eastern Tennessee, known as the Appalachian Region. Just last week the Government purchased eighty-five thousand acres near me, in eastern Tennessee, for a forest reserve, and will continue to purchase large areas, so that we will have the backing of the Federal Government in the fighting of this disease in the future. I shall, however, call the personal attention of the Governor to this matter, so that we may take it up ourselves, as a State, and I trust that, when the matter comes to our attenion personally, we shall have some means that will help to battle with the disease, if it should occur. I am very much interested in listening to these discussions, and I think I shall go home very greatly profited. As I am a tanner and an extract man, I am personally and financially interested in the prevention of any loss of chestnut timber. I might say to you, for your information, that a large number of the trees in our country are very old. The Federal Government inspectors who have been in those forests have placed the age of those trees from two hundred to four hundred years, and some of them range as high as eight feet in diameter,—immense trees. The area is so large and the chestnut timber growing so thickly that it affects us, or would

affect us, vitally in a number of directions. The water supply or water sources will be vitally affected if this disease should get the better of us and cover very much of our vast territory. I assure you that none of you are more vitally interested in this matter than the people of Tennessee, for the great reason that we have so much chestnut.

THE CHAIRMAN: Is there any inquiry from Tennessee? The next is Canada, Dr. Gussow.

DR. H. T. GUSSOW: I do not think I need to take up the time of the meeting this morning. I have already expressed my observation that the disease is not present in Canada, and that we have very few chestnuts. I have come here to profit by your information, which I am grateful to say, I have been able to do.

THE CHAIRMAN, (Mr. Pearson): The Chair committed a slight error in suggesting that President McFarland would be available to make suggestions regarding seeing the city. He should have mentioned Mr. Bell, who was mentioned by President McFarland, and who will be available after this meeting.

I have been requested to make the following announcement: Please inform this meeting that a good photographer will be at the main entrance immediately after adjournment to take a group photograph,—at the main entrance where the statuary is. The size of this will be 11 x 14 and the price one dollar per copy for those who desire to get copies. It is urged that each one go at once to the main entrance, so as to be in this photograph, whether you choose to buy it or not.

Deputy Commissioner Williams will present a communication from the President of the United States.

MR. WILLIAMS: The following letter accompanied by certain documents, has just been received by Governor Tener, and I am requested to present it to this meeting:

"White House, Washington, February 19, 1912.

My dear Governor:

I herewith enclose a communication from the Secretary of the Department of Agriculture, in which he gives all the infor-

mation which is available in his Department upon the question of the chestnut bark disease which is to be considered in a public meeting in your capital to-morrow.

I hope that this communication may contain certain information of value to your people in fighting this very destructive enemy of one of our most beautiful trees, and you have my very earnest sympathy in your efforts to accomplish the desired end.

Sincerely yours,

(Signed) W. H. TAFT."

(Applause).

MR. WILLIAMS: This is accompanied by a letter of Secretary Wilson, transmitting the information requested by the President, a copy of Bulletin No. 467, and a statement of the present status of the chestnut bark disease, signed by William A. Taylor, acting chief of Bureau.

It was moved and seconded that the communication be referred to the Committee on Resolutions.

The motion was put and carried.

The letter of Secretary Wilson, referred to above in the letter from President Taft, is as follows:

"Department of Agriculture,
Office of the Secretary,
Washington, February 19, 1912.

Dear Mr. President:

Our experts in the Bureau of Plant Industry have given the chestnut bark disease situation much attention for some time past, and are convinced of the urgency of the present situation. They have prepared the inclosed memorandum which indicates the present status of the chestnut bark disease and the importance of prompt action, if its further spread is to be prevented and serious loss to the people of the entire Appalachian region is to be averted.

Sincerely yours,

(Signed) JAMES WILSON,
Secretary.

To the President."

The communication referred to in Secretary Wilson's letter to the President, indicating the present status of the chestnut bark disease, is as follows:

United States Department of Agriculture,

Bureau of Plant Industry,

Office of Chief of Bureau.

Washington, D. C., February 19, 1912.

MEMORANDUM FOR THE SECRETARY.

Regarding present status of chestnut bark disease.

This disease, which was first recognized as serious in the vicinity of New York City in 1904, appears to have been present on Long Island as early as 1893. Its origin is unknown, but there is some evidence to indicate that it was imported from the orient with the Japanese chestnut. In southwestern Connecticut, southeastern New York and northeastern New Jersey a majority of the chestnut trees are already dead from the bark disease. Outside of this area in western Connecticut, eastern New York, western New Jersey, southeastern Pennsylvania, northern Delaware, and northeastern Maryland the chestnut trees are practically all infected. Outside of this area from the northern border of Massachusetts and from Saratoga county, New York, southwestward to the western border of Pennsylvania and the southern border of Virginia, scattering areas of infection are known to occur and may be expected at any point. So far as is known the disease is limited to the true chestnuts and chinquapins. It is not certainly known to occur on oaks, beeches, horse chestnuts, or other forest trees.

The bark disease appears ultimately to exterminate the chestnut trees in any locality which it infests. The financial loss from this disease in and about New York City was estimated three years ago at between five and ten million dollars. A conservative estimate made in 1911 by the experts in the Bureau of Plant Industry indicates a loss in the states infected, up to that time, of twenty-five million dollars. The heaviest damage thus far has been to chestnut trees in localities where this species is grown chiefly for ornamental purposes, rather than for lumber. It has now reached a point in its spread where the entire chestnut timber belt of the United States, comprising portions

of the States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New, Jersey, Pennsylvania, Delaware, Maryland, Virginia, West Virginia, Ohio, Indiana, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Alabama and Mississippi are likely to become involved. As the disease is spread from tree to tree by spores of the fungus which causes it, the spread is usually rapid after a single tree in a locality is infected.

There is evidence that the spores are spread through short distances by rain; through longer distances it appears possible that it is spread also by birds, insects and rodents, such as squirrels. The disease is carried bodily for considerable distances in tan bark and in unbarked timber derived from diseased trees. It is also frequently transported on diseased nursery stock.

No method of immunizing individual trees is yet known and no method of treating or curing them when once attacked is certain in its results. This being the case, so far as the chestnut forests are concerned, the only practicable method of dealing with the situation is that of prompt location of isolated centers of infection in advance of the main line of the disease, coupled with the prompt cutting out and destruction of such scattered diseased trees. This method has been tested sufficiently to indicate that it is practicable to control the disease where the situation is effectively attacked before a general infection has resulted. In addition to this it may be found necessary to establish an immune zone by destroying all chestnut trees, diseased or healthly, in a belt ten to twenty miles wide, or possibly less, in advance of the main area of infection, with a view to barring its progress. A regional quarantine of chestnut products likely to move from the area of complete infection to protected territory may be found necessary. This is now a subject of consideration in the investigations that are under way.

The disease having already done much damage in eastern Pennsylvania and northeastern Maryland, but not having appeared to a destructive extent in the states farther south, it is peculiarly important at this time that effort be made to stay the progress of the disease before it reaches the heavily timbered chestnut areas of Maryland, West Virginia, Virginia, and the mountain regions farther south. The fact that the State of Pennsylvania has ap-

propriated $275,000 for the eradication or control of the disease within its borders is an indication of the importance with which the matter is regarded there. Congressional action with a view to making possible effective co-operative effort to control the disease by Federal authorities in co-operation with the authorities of the several states interested, before it is spread to a point beyond control, appears to be of the utmost importance.

Very truly yours,

(Signed) WM. A. TAYLOR,

Acting Chief of Bureau.

NOTE.—The accompanying document sent with the President's letter, "Farmers' Bulletin, No. 467," is not reprinted herein, but may be obtained without charge upon request, from the United States Department of Agriculture, Washington, D. C. This Document is entitled "The Control of the Chestnut Bark Disease," by Haven Metcalf and J. Franklin Collins. Issued under date of October 28, 1911.

THE CHAIRMAN: The programme now calls for coming together at two o'clock, and the first paper will be by Dr. Hopkins, on the insect question. No one can regret more than the Chairman that the general discussion has been crowded out this morning. Would it seem wise to begin our meeting this afternoon at a quarter before two, in order that we may have a little more time?

MR. WILLIAMS: I make that motion.

The motion was seconded and duly carried.

THE CHAIRMAN: I am asked to announce that the professional foresters,—all professional foresters, are invited to meet in this room at 1.30 P. M., fifteen minutes before our meeting time, for some general purpose.

MR. WILLIAMS: I wish to announce that the Committee on Resolutions will meet in the House Caucus room, immediately beneath this chamber, after adjournment, this morning.

The Chairman announced that the Convention stood in recess until 1.45 P. M.

AFTERNOON SESSION.

Wednesday, February 21, 1912, 1.45 P. M.

THE CHAIRMAN: The meeting will please be in order. We are to have first this afternoon, a paper by Dr. A. D. Hopkins, who is in charge of forest insect investigations, Bureau of Entomology, U. S. Department of Agriculture.

DR. HOPKINS: Mr. Chairman: I regret exceedingly that the insects are interfering in this trouble, and making more of it. Heaven knows they are making enough trouble of their own all over the country. They are killing the merchantable sized pine in the Rocky Mountains and on the Pacific Coast at a greater rate than that by fire alone. They are killing the pine in the South. They are killing the hickory, they are killing the oak and the hemlock, and now they are interfering in this disease. They are also killing chestnut on their own account.

Mr. Chairman, I have two papers here, both about the same thing. One is an abstract which will take about ten minutes; the other is the whole paper, which will take about half an hour. I presume you would like to have the abstract, which will take less time.

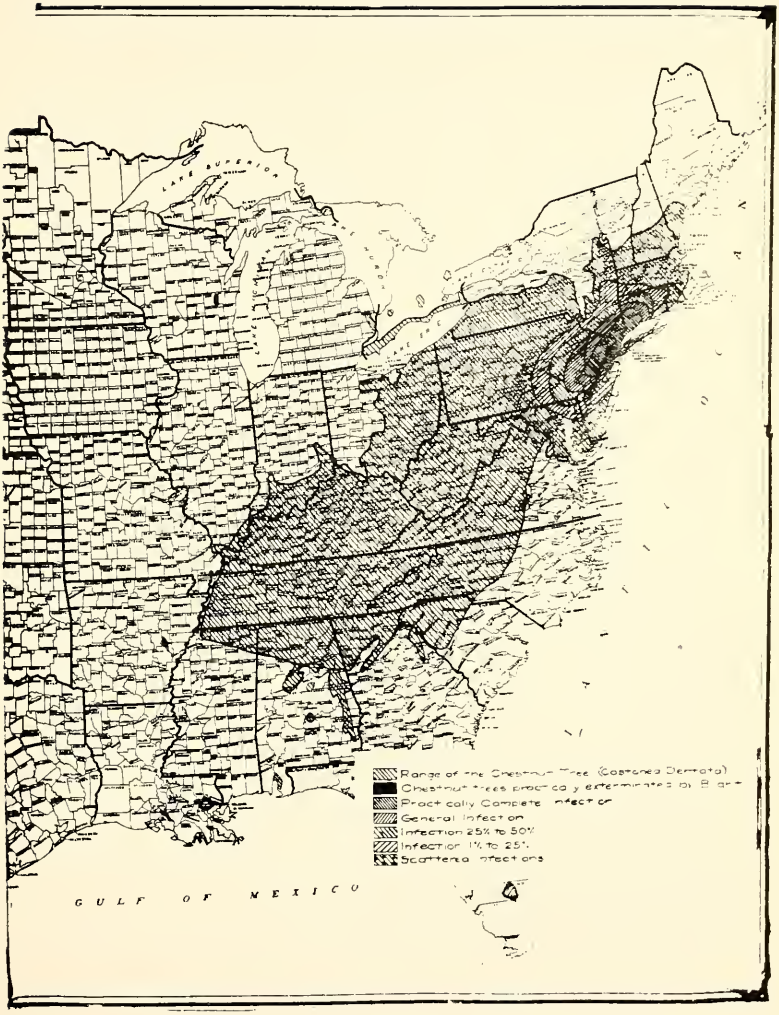
THE CHAIRMAN: I presume it would be better to give us the abstract, and then, if there is more time available, let it be spent in general discussion. Will that meet with your approval?

DR. HOPKINS: Yes; that is what I intended to do.

Dr. Hopkins read the following paper:

While the history of the discovery of the chestnut blight disease and its spread from a local to an interstate problem is well known and much interest is manifested in the subject, the history of extensive dying of chestnut from various other causes is not so well known.

When we review the history of extensive dying of chestnut during the past half century in Mississippi, Tennessee, Georgia, South Carolina, North Carolina and Virginia, it is surprising



Map showing range of the chestnut tree, and comparative percentage of the chestnut bark disease.

that there are any living trees left. In fact, there are not many left in some sections of these States where the tree was abundant and healthy fifty years ago.

It appears that there are a number of agencies of destruction other than this new chestnut blight disease, and that these agencies have been in operation in the area affected by the disease as well as in areas where this disease is not known to occur. Therefore, they must be taken into consideration and investigated before the problem of protecting the chestnut can be solved.

There appear to be other diseases and we *know* that there are insects which have been directly or indirectly the cause of the death of a large percentage of the chestnut over extensive areas.

One species of insect, the two-lined chestnut borer, is perhaps the most destructive insect enemy. It has been investigated and methods of controlling it determined and demonstrated, and there is no lack of published information on the subject.

There is also a combination of insects and the chestnut blight disease. Investigations by forest pathologists have revealed the fact that the spores of the chestnut blight find their way into the living bark through some wound and that the majority of such wounds appear to be caused by bark-boring insects.

Recent investigations by forest entomologists tend to verify this general statement, and that a large number of species of insects are involved.

Inasmuch as the insects make a primary attack and the disease is largely dependent upon insects to continue its destructive work, it is also plain that we have an insect problem of perhaps equal importance to that of the blight itself.

It is also plain that this interrelation of insects and disease presents a new and complicated problem which will require a great deal of exact scientific research by the forest entomologists and the forest pathologists before we shall be warranted in arriving at definite conclusions, or in giving specific advice on methods of control and prevention.

Considerable work has already been done on the general subject of chestnut insects by the West Virginia Agricultural Experiment Station and the Bureau of Entomology of the U. S. Department of Agriculture since 1893. The published and unpublished records of these studies show that three hundred and

fifty-four species of insects were found to inhabit the chestnut. We find that other observers have recorded one hundred and sixty-four species. By eliminating all duplications, the total is four hundred and seventy-two. So you see that the chestnut is pretty well inhabited by insects. This is only a beginning. There are many more insects to be found on the tree and a great deal to be learned about them as a basis for practical conclusions and action. A more specific and comprehensive study of chestnut insects is now being carried on under a special project of the Branch of Forest Insects of the Bureau of Entomology. This investigation will be extended into all parts of the country where the chestnut is, or has been, an important forest tree, and especially in those States and sections where the people representing the private, municipal, and State ownership manifest a special interest in this phase of the problem. We are assured of the co-operation of the Commission and other State officials in the work carried on in Pennsylvania and we hope to have the co-operation of other States in any work done within their boundaries.

Possibilities of Control.

You will note that I am not discussing the control of the disease, because I do not pretend to know anything about that, but that, as the insects are related to the trouble and the primary cause of the wounds, we must consider control of the insects as a primary measure.

In the consideration of the possibilities of controling depredations by the insects, it may be stated that under certain conditions of public interest, with facilities for utilization of the affected product, and with a knowledge of the fundamental facts and principles relating to the depredators and their control, it is entirely possible and as a business proposition it will pay.

On the other hand, it has been forcibly demonstrated in a number of cases that have come under our observation that any direct attempt to combat an insect depredator without a knowledge of essential facts and principles will result in failure and a waste of energy and money. It has been shown that a few hundred dollars expended in practical application after the essential facts have been determined will accomplish more than many thousands of dollars expended without such knowledge. In

other words, practical application must follow and not precede scientific investigation and expert advice, just as legislation for the control of forest insects to yield good results must follow and not precede education on the principles and methods of control.

The steps toward the successful protection of forest trees from their insect enemies are:

1. Investigations to determine the essential facts about the principal insects which are capable of killing the trees.

2. Concentration of the investigations on the most important species to determine their seasonal history and habits, and the most economical and effectual methods of preventing serious depredations by them.

3. Dissemination of authoritative information on the essential facts and principles of control and prevention, by means of circulars, press notices, lectures, special field instructions, and field demonstrations.

4. Practical application of this information by the owners of affected and threatened timber, under a strict adherence to the recommendations.

I might pause at this point, to make it clear, that we are conducting now and have conducted a number of practical demonstrations to prove that our recommendations will work, and we have proved it in a number of cases. In one case last summer, involving the cutting of over twenty thousand trees, over a very large area in Oregon we demonstrated the practicability of controlling one of the worst insect enemies of western forests. In one locality in Montana over ten thousand trees were cut by private owners, small owners. They cut the timber and worked it into fuel and burned it during the winter and stopped insect depredations which had been going on for twenty or thirty years and killing an enormous amount of timber. The timber stopped dying the next year. I had a letter informing me, just before I came here, that over one hundred Indians were cutting and barking timber according to our recommendations in an Indian reservation in eastern Montana. This is a demonstration project, and the Indians are so much interested that they have authorized the expenditure of ten thousand dollars, and they are cutting the timber and barking it themselves. This, we believe, is almost

certain to be a success, and we will be prouder of it than anything else we have done, because it shows that, if the Indians can do it, anybody else can do it.

Continuing my paper, in conclusion, I want to say that in our general investigations and practical demonstrations, we have recognized that the State and Federal governments can render the greatest service through investigations and the dissemination of information and that it is the owner who should make the practical application. Therefore, this chestnut problem is the people's problem and especially that of the people who are owners of valuable natural or cultivated growth. It seems to me that the only way the successful protection of the chestnut resources of the country can be brought about will be through individual and co-operative action by the owners. They are the ones to be directly benefited, financially and otherwise. I am sure that, as a rule, they are anxious to do everything they can afford to do, if someone will show them how and demonstrate to them that, as a business proposition, it will pay. They will then not only try to protect their own timber but they will realize that there is a common interest involved and will be impelled to help their neighbors, their county, and their State.

I have some photographs here which I took in 1903 in North Carolina, showing the extensive dying of chestnut there. The chestnut, practically dead as far as you could see in every direction, the white, barkless trunks appearing as ghost trees in the forest. I have also a list of the insects found on chestnut, which of course you do not want me to read.

THE CHAIRMAN: Dr. Hopkins has some photographs here illustrating some of the insect pests, and I am sure he will be glad to show them to those who are interested, after this session is over. The paper of Dr. Hopkins is open for discussion. I know he will be glad to answer questions that may arise pertaining to the relation of the insects to the chestnut bark disease, or any other questions that may come up in relation thereto.

DR. MURRILL, of New York: I would like to ask Dr. Hopkins how far these beetles which attack the chestnut have been known to go from tree to tree in a forest?

DR. HOPKINS: That is not known. We have no way of determining how far they will go. But they have wings and can fly. There is no reason why they should not go long distances.

DR. REED, of Virginia: I would like to ask how many of these insects are borers in the chestnut that would inflict any wound in the bark which would be large enough to allow infection by a fungus?

DR. HOPKINS: There are a number of insects which may cause wounds which will give entrance to the spores. When the insects hatch from the eggs, they are almost microscopic; therefore, the burrows made going into the bark will hardly give entrance to the spores unless there is a flow of sap from these small wounds, which sometimes happens. My observation in Virginia and the section south of Washington indicates that there is a disease, possibly a bacterial one, which does get into these minute wounds, on account of a small amount of the sap oozing out, and in that way it works into the cambium. This is only a possibility which has been suggested time and time again to me by my observations; perhaps it acounts for the fact that great numbers of dead trees in the South, do not show any traces of insects. The trees die and the bark falls off and yet they show no evidence of insects. Of course, the majority of dead trees do show such evidence. We have had a man down in North Carolina in 1903-1904 studying the insects, and trying to determine the cause of the extensive death of the timber in that state, and there was no doubt that a great many of the trees were killed by insects, but that insects were not the cause of all of the trouble.

DR. REED: Is there any part of the tree which is invariably attacked by these insects, or does it occur generally on the tree?

DR. HOPKINS: The principal point of attack, the most vital part of a tree, is the middle trunk. We have found, in the study of insects which kill trees, that they attack the middle portion of the trunk. They girdle the tree at that point. The two-lined chestnut borer does this especially. Other insects attack all parts of the tree including the leaves, and some of them are associated with the chestnut blight, as has been determined by Mr. Craighead, who has been carrying on work under my instruction here in Pennsylvania.

MR. BARRUS, of New York: I would like to ask: Is there any case where the larva of the insect is found under the bark, and the mycelium of the fungus is found radiating from the burrow of that insect? I would like to know whether that is known to Dr. Hopkins, and whether that means anything relative to the spread of the disease? Would it be possible that the spores of the fungus were deposited at the same time the insect was deposited there in the egg, and a mycelium growth had gone on parallel with the development of the larva?

DR. HOPKINS: That is a problem yet to be solved. It is a problem in which we will have to co-operate with the forest pathologists. We are studying that feature of the problem. We find insects undoubtedly associated with the disease. We find them going into the perfectly healthy bark of some trees and we find the disease following them. We find also that insects go into the healthy bark or other trees, and the disease does not follow; so that it is one of the complex problems to be worked out. I think it is absolutely necessary to work out a few of these problems before we can do much towards control. I think it will save money. We certainly ought to know something about what we are doing.

MR. BARRUS: A number of articles have been sent in for identification, reported as the work of insects which had not worked in healthy trees, and I wondered whether it was meant by that whether those insects would work on a tree after it had lost a certain degree of vitality, even before the tree had died.

DR. HOPKINS: It depends on the species. There are very few people who can recognize the different species of insects in the larval stage. We have specialists working on this now. The identification of species from the larval stage is something the general entomoligist cannot do. Any assumption, from the larval form alone, that certain insects will do so and so, is mere guesswork. Some species of insects will bore in the living bark. Others can not possibly exist in the living bark but must bore in the dying, dead or decaying bark. There are many species, as this list shows, over four hundred and seventy-two species, and out of those there are only a very few which attack perfectly healthy

trees. So that the others live in various ways. If a lot of insects is found in a diseased tree, we must know which of these are the insects that attack the living bark and which come in after the bark begins to die, or after it is dead, and whether or not any of them can carry spores after they transformed into the adult stage and come out. I doubt whether the relation of insects is as important a factor as has been suggested, because as a rule when insects develop to the adult or winged stage, and emerge from the bark, they fly away very quickly, as if to escape some enemy. They do not as a rule crawl about over the bark before they fly.

MR. W. HOWARD RANKIN, of Ithaca, New York: Can you tell us whether in your estimation, the Leptura species of borer precede infections of the blight, or follow it?

DR. HOPKINS: That is a problem we are working on, but we are not ready to form an opinion on it. It will require a summer's work before we can state definitely just what relation they have to the disease and the dying of trees.

MR. RANKIN: I would also like to ask the Doctor if he is acquainted with some chestnut trouble in Otsego county, New York? There is a lot of chestnut dying in that locality from what I took to be insect trouble.

THE CHAIRMAN: Mr Rankin calls attention to apparent losses caused by insects in Otsego county, New York

DR. HOPKINS: The matter has not yet come to my attention.

THE CHAIRMAN: Are there further questions?

PROFESSOR CLINTON: I would like to ask Dr. Hopkins if, during the past few years, the insect troubles of trees in general have been on the increase or decrease, over the previous ten or fifteen years?

DR. HOPKINS: I have been studying the subject in relation to dying timber for the past twenty years, or since I started to study forest insects, and the question of climate has been one to which we have given considerable attention; because every time trees start to die someone comes up and says they are dying

from drought, or if it is a wet season they claim they are dying from wet weather. We have demonstrated conclusively, I think, that insect troubles do not depend on drought. In fact, the most destructive insects work better under moist conditions. So far as the relative abundance now and formerly is concerned, it is the habit of all destructive insects to be very destructive for a series of years and then practically disappear. This is, under natural conditions they go in waves. There is no particular period, but whenever the conditions, whatever they may be, are favorable for their rapid increase, and their enemies are not present in numbers, they start another invasion and sometimes kill off nearly all their host trees. The most striking example of the complete extermination of an insect throughout a vast area was in 1893. In 1891 and 1892 the pine throughout West Virginia and Virginia was dying at an enormous rate. We found that it was being killed by the southern pine beetle, which was threatening the total destruction of all the timber in those two States, and did kill from seventy-five to eighty per cent. of the best merchantable timber. In the winter of 1893, in January, it was twenty-five degrees below zero in many sections in this area. The next spring when we went into the woods to continue our investigations, we found all of the broods of this beetle dead, and as we continued the investigation we found them dead all over the area. Since that time to the present, there has not been a single specimen of that beetle found in the area mentioned. This is an example of climatic influence. If we could have something of that character come along and clean out the chestnut blight, it would settle all this trouble; but we can not depend on such things to happen. This killing of the southern pine beetle by cold was due to the fact that it is a southern insect which had worked its way northward during mild seasons, so that when the extreme cold came it was exterminated. This cold did not kill any of the local insects that were working in the bark with it. The same insect is now threatening the destruction of the timber throughout the southern States. Our work in the south during the past summer has led to the extensive cutting of infested trees by the owners in carrying out our recommendations, and I think the beetle will be controlled.

THE CHAIRMAN: You will all be pleased to know that Governor Tener very willingly accepted an invitation to come in and say a few words this afternoon before our final adjournment.

This morning, after considerable labor, we formulated some rules to govern a discussion that never occurred. It occurs to the Chairman that it might be well to open up the subjects of the morning session, in connection with the one subject presented this afternoon, under the rule adopted this morning and continue along that line until the Committee on Resolutions is ready to report. If no objection to that proposal is made, it will be understood that it is the wish of the Conference so to proceed, having the paper presented by Dr. Hopkins and the papers presented before us this morning for discussion on a three-minute rule.

DR. MICKLEBOROUGH, of Brooklyn: Mr. Chairman and Gentlemen: I have given some four years of study, more or less, to this fungous disease causing the death of the chestnut trees. A great many of you have seen the pamphlet which I wrote for the State of Pennsylvania. I am indebted for my first knowledge of this subject to the gentlemen just in front of me, Dr. Murrill, of New York. My attention in 1907 was called to it in Forest Park in Brooklyn. Let me say a word or two to those who are using the microscope. I think perhaps one or two errors may have been stated here, and I want to call attention to the spores that are developed by this fungus, the *Diaporthe parasitica.*

This fungus produces four kinds of spores. The two most abundant and generally found are the sac spores in the winter stage and those other spores in thread masses called conidial spores, and which are present in the summer stage. Besides these there will be found in some specimens, numerous small spores (or cells) which are developed in a flask or perithecium called a spermagonium. These very minute spores (or cells) of the spermagonium are called spermatia. Besides being very small they possess great motility. There is a fourth kind also developed in a flask or perithecium which is called a pycnidium.

The pycnidial spores (or sporules) are from two and a half to three times the length of the conidial spores. The sporules are borne on pedicels and are not contained in sacs as are the winter spores. A pycnidium may properly be called a stylosporous perithecium. These four kinds of spores, vary in size and are of a different origin. The condial spores are the only kind not produced in perithecia or flask-shaped bodies. The conidial spores are borne on filiform, simple hyphae. The sac spores are called *sporidia,* the thread mass are *conidia*, the minute spores (or cells) are the *spermatia,* and the pycnidial product are the sporules.

THE CHAIRMAN: Doctor, I think I will have to ask for unanimous consent, because we have now gone to the limit of our rule.

DR. MICKLEBOROUGH: I would ask consent that I may be able to present a statement that I think is of some importance in the work which I have been doing just lately.

THE CHAIRMAN: Can you give us an idea of the time?

DR. MICKLEBOROUGH: I will take just a few minutes.

THE CHAIRMAN: Dr. Mickleborough asks unanimous consent that he proceed for a few minutes to complete this statement. It seems to be necessary to ask that, because we are working under a rule. Is there objection? If not, the consent is given.

DR. MICKLEBOROUGH: I will take up the other feature. I have had under consideration all forms of sprays and cutting and things of that kind, and have examined the cuttings in many parts of New York State and also in Pennsylvania. I want to make this statement, not to produce any sensation or create any false impression: Within the last five months I have had associated with me in this work an experienced bacteriologist, and last Friday I called upon my associate and I asked him to give me the language that I might use as to what we had accomplished up to this time in trying to find an entirely different remedy for the chestnut tree blight. I will read you the words that he approved of last Friday; that was February 17, 1912:

"The work has advanced sufficiently to state that temporary immunity is assured to a certain degree." That means over certain areas and over smaller things with which we have had to deal in the bacteriological laboratory. "And spore development in affected areas has been arrested."

Now we have started out largely with the idea that dog will eat dog and that we will have to meet this from the bacteriological standpoint. I do not know; and I do not promise success. We are going ahead with this work and many experiments will have to be preformed this spring. I am not sure that we are going to be successful, anl I am not going to tell you whether it is going to be a toxin or an anti-toxin, as we might call it, or a serum which can be used.

MR. STEVENS: This is a very interesting paper and we enjoyed it; but we have taken up so far in our Conference the negative side of the question and, with the limited time left, I think we have all we can do to consider ways and means of procedure. I think it should be the sense of the meeting that we should give the remaining two hours of time to positive work, in the procedure of the work of this Conference.

DR. MICKLEBOROUGH: I have no desire to prolong this discussion at all against the wish and the unanimous consent of the Conference, and I am not wishing to create a false impression. What we may be able to produce I do not know. I do know this, that it is something that ought to be encouraged, just as much as when the sleeping sickness in Africa killed a million of the tribes of Africa. The white man did not say, "Let them die" but rose up, as a man, the rebel in nature, and said "I will not die, but I will destroy that which is destroying me." and I am taking that position now. We are trying to see if there is not something that can be done to destroy the chestnut tree blight. I yield to the gentleman; if there is any objection, I do not wish to continue.

THE CHAIRMAN: The matter before us comprises the papers of this morning, with their various bearings, and the paper of the afternoon. There are four distinct subjects.

DR. SMITH: There has been a manifest desire that all possible information be given here of the experiments of Dr. Metcalf,

whose publication has raised the hope that the dead line is to be effective. Possibly Dr. Crowell can tell us something about it, or some other member of the Department.

THE CHAIRMAN: That would be eminently proper under the rule guiding us at the presene time. We would be glad to here from Dr. Crowell for three minutes, and extend the time, if the Conference desires; either Dr. Crowell of Professor Collins will speak.

PROFESSOR COLLINS: Mr. Besley made the remark, I do not remember whether it was this morning or not, that he would like to have some positive statements. I am prompted to say a few words about the matter. I should have said them before, only the discussion seemed to be so close on to the time limit that I thought perhaps a little more favorable opportunity might occur later.

In reply, if we can regard it a reply to the question of Mr. Besley and Professor Smith, I would like to say a few words in regard to the cutting-out experiment around Washington. You must remember that in the Farmer's Bulletin which has been published, the statement is made that those experiments were conducted chiefly by the senior writer, which is Dr. Metcalf. We are all sorry that he cannot be here to tell you more about this. Unfortunately I have visited only a few of these places personally. Here is a statement, however, which I would like to read in connection with that:

In Farmer's Bulletin 467, p. 11, we made the following statements regarding certain experiments which had been performed at that time to test different methods of controlling the disease by cutting out advance infections:

"The country within approximately thirty-five miles of Washington, D. C. was chosen in the fall of 1908 as preliminary territory in which to test this method of control. This section has since been gone over fairly thoroughly once a year. As will be seen by Fig. 1, fourteen points of infection were located and the infected trees destroyed. Most of this work was done by the senior writer. The largest infection was a group of nursery trees that had been imported from New Jersey; the smallest, a single lesion on a small branch of a large forest tree. In one

case eleven forest trees in a group were infected, the original infection having been two trees, dating apparently from as early as 1907. Up to the present time (June, 1911) the disease has not reappeared at any point where eliminated and the country within a radius of approximately thirty-five miles from Washington is apparently free from the bark disaese, although new infections must be looked for as long as the disease remains elsewhere unchecked. It is therefore believed that this method of attack will prove equally practicable in other localities, and if carried out on a large scale will result ultimately in the control of the bark disease."

Since June, two new points of infection, dating probably from 1910, and a third suspicious point have been discovered within this area. This was expected, as above. If the results of legislation this winter show that an effort will be made to control the disease in Maryland, Virginia, and the District of Columbia, these points of infection and any others that may be found will be destroyed in the spring. Otherwise the experiment will be abandoned, except for keeping a record of previous cuttings.

Since Christmas six of the fourteen points above referred to have been visited. In one case where only diseased limbs were removed and the balance of the tree left standing, the tree has become infected. This was expected; we have always recommended complete destruction of diseased trees. At two points the diseased trees were cut, but the stumps left unbarked. This we believe to be bad practice, but in spite of this the stumps are still with one exception unaffected. In the other three cases the trees were entirely destroyed, and the disease has not reappeared in the vicinity. The regular inspection of all fourteen points will be made again in May and June, after the leaves are out, as has been our previous practice.

Only indicative conclusions can be drawn from the above experiment until at least six more years have passed. It should be borne in mind that this is an experiment, not a demonstration. The experiment should in any case have been duplicated in various parts of the country. It is not too late to do this now; even in States where it is too late to attempt general control, local

cutting-out experiments can be made, and the end will give results of great value, on account of the difference in local conditions.

DR. MURRILL, of New York: Mr. Chairman: I wish to speak just for a moment in reply to the preceding paper, and I wish to speak very briefly and plainly, as to why the chestnut canker cannot be controlled by cutting-out method proposed:

1. It is impossible to locate all advance infections, these not being apparent even under close inspections.

2. It is practically impossible to cut and burn all infected trees after their discovery.

3. Even if these trees are cut, it is impossible to discover and eradicate the numerous infections originating from millions of spores produced on these trees and distributed by birds, insects, squirrels, wind, and rain.

4. Even if it were possible to cut and burn all affected trees, for ten or twenty years afterwards numbers of sprouts would grow up from the roots of these trees and continue to die from the disease and to spread the infection.

5. Supposing that it might be possible to eradicate all advance infections, what method is proposed that is at all feasible for combating the disease in its main line of advance? All of the foresters connected with the United States Government and the entire Army of the United States would be utterly powerless to oppose its progress.

6. Although the chestnut canker has been known and experimented with since 1905, there is not a single instance where an individual tree or a grove of trees affected by the disease has been saved. If it is impossible to combat the canker under the most favorable circumstances, how would it be possible to succeed with an extensive forest? The published account of the extermination of the chestnut canker in the vicinity of Washington, D. C., upon which experiment the requests for state appropriations are said to be founded, cannot be relied upon. The trees most conspicuously affected there have been cut and burned, so that the presence of the disease is not readily apparent, but with each season additional trees will be affected and

the attempt to stay the disease will be abondoned, especially when the main line of advance, which is now in northern Maryland, reaches the Potomac River. (Applause).

MR. CASSELL, of Philadelphia: I wish to say to Dr. Murrill that I will be glad any time to show him trees that have been treated for two years and are alive to-day and apparently quite healthy. (Applause).

PROFESSOR STEWART: Mr. Chairman: I wish to speak of two points mentioned by Professor Collins in connection with the Washington experiment. I think that he has left the impression that those points of infection discovered after June, 1911, could be regarded as new infections. Now, one of them, which we examined, Professor Collins says must have occurred in 1910, and I quite agree with him that it occurred as early as that, and perhaps earlier. That certainly cannot be regarded as a new infection. Another point: Professor Collins states that in those two cases where the trees were cut and the stumps left unbarked, that the disease has not reappeared. Perhaps he did not put it quite that way; I believe he said, "they are not now infected." Now on the 30th of December last, when we examined them (Dr. Metcalf, Prof. Collins and others being present), we found the fungus on the bark of one of those stumps, and also at the base of an adjoining tree, as stated in my paper.

MR. I. C. WILLIAMS: Mr Chairman: I wish to direct the attention of this Conference to the character of some of the scientific investigation that is going on with respect to chestnut blight disease. I think we have a right to know what some scientists are doing, what they are saying and what they are attempting to do. It is for that purpose, therefore, that I have brought before you a copy of the report of the New York State Museum, and I wish to read you a short paragraph therefrom. On page 7 of that report it is written as follows:

"While there (referring to a locality which was visited) my attention was called to a diseased chestnut tree. It was a young tree, with sickly looking foliage and a few dead branches. It was suffering from the chestnut bark disease, caused by a parasitic bark fungus. Both branches and trunk were affected by the fungus, the latter dead a few feet above the

ground. It was my first opportunity to see a tree affected by this disease, about which much that appears to me to be overdrawn and needlessly alarming has recently been published in magazines and newspapers."

This is dated Albany, May 15, 1911. You will bear in mind that the writer admits having seen but one diseased tree from which he draws that conclusion; and (to Dr. Murrill), if my friend will just bear with me a moment, he will get an opportunity when I am through.

THE CHAIRMAN: The three-minute limit having expired, we will understand, unless there is objection, that Mr. Williams has unanimous consent to continue.

MR. WILLIAMS: I hold before this meeting that it is a case of ridiculous and absurd foolishness for a man to come out in a public print of that character and, as a reputable scientific man, wishing to be taken seriously, say that because he has seen one diseased tree he regards this thing as needlessly alarming, and all trumped up and in the air. If that is the kind of scientific aid we are getting, then much of our scientific work is useless. Much of it is just as useless as the conclusions that were drawn here yesterday from some of the papers read. They are simply guesses in the future, strokes in the dark; they amount to nothing. One man can guess at something as well as another. If the practical men of America are to pin their faith to guesswork resulting from the cursory examination of one tree, then I say it is pretty nearly time to call off the scientists and let us look to somebody else.

PROFESSOR CLINTON: The politicians.

MR. WILLIAMS: Yes, sir, they will help. You will find that when a politician sees something good, he goes for it and generally gets it. He, at least, has courage enough to try.

In regard to the article just read before you, I happened to have a copy of that in my hand. I suppose the gentleman who read it is somewhat mystified as to how I got it; but if he desires to know, the information may be had. It may be interesting to this meeting to know that it was one of his pre-Convention efforts in some way to cook up a sentiment, or an apparent sentiment,

against what possibly might be done at this meeting, and was accompanied by such a letter as I rather expected would never be written.

The first statement is: "It is impossible to locate all advance infections, these not being apparent even under close inspection."

I deny the assertion. Advance infections can readily be found if the man looking for them knows his business. In time every tree will develop to such a stage in its infection that it may readily be detected. There is no hidden mystery about this disease. All you have to do is to know it and find it. It takes probably repeated searching, but when you go out for a thing you search until you get it. You do not look for it in a desultory way and then say "It is impossible to find all advance infections."

"It is practically impossible to cut and burn all infected trees after their discovery."

Who for a minute will believe that it is impossible to burn a tree if you cut it down?

"Even if these trees are cut, it is impossible to discover and eradicate the numerous infections originating from millions of spores produced on these trees and distributed by birds, insects, squirrels, wind and rain."

If we cannot eradicate, we may check. We may do something that will be beneficial, and if it is impossible to do as stated in paragraph 3, then let us do the next best thing. Let us not quit because some one thinks that it probably is impossible, but let us go ahead and do the best we can. I question the propriety of anyone engaged in work of this kind and in relation to this disease being ready to give up after the first effort.

"Even if it were impossible to cut and burn all affected trees, for ten to twenty years afterwards numbers of sprouts would grow up from the roots of these trees and continue to die from the disease and to spread the infection."

I would like to know whether that observation is based upon facts, or whether it is a mere guess, an assumption. An incident was cited to you this morning where a number of infected trees were cut out of a grove near Philadelphia. The bark was carefully taken from the stumps, burned, every infected portion of tree that could be found was destroyed, and the sprouts from

those stumps have come up in a fine, thrifty manner. To date they show no infection. That is not complete evidence, of course, but it is an indication. It is an indication that these stumps will sprout again and they may possibly be kept free from infection. How much easier it is to go back to the stumps and cut the small sprouts than to search for the disease on tall forest trees. "Supposing that it might be possible to eradicate all advance infections, what method is proposed that is at all feasible for combating the disease in its main line of advance? All of the foresters connected with the United States Government and the entire Army of the United States would be utterly powerless to oppose its progress."

I would like to ask how that was arrived at. By what process of calculation has that statement been derived? I would like to ask what method they propose. Do they have a method? Is there any method that is worth anything at all? Now if there is, let us use it. If there is not, let us look for one. We are interested in looking for one. We claim no method that is of great virtue, but we do claim that we are interested in looking for a method, and that is the thing we want to do.

"When an appropriation is asked for, it is customary to point to some good reason for hope of success provided the appropriation is obtained." In other words, you must solve your problem before you get the money to solve it. If that is the way the States of the United States are doing business, then I think they had better reform their methods of business quickly. If that is the way the scientific men of the United States do their work, I think it is well for them to get wise.

Now Mr. Chairman, I do not want to be misconstrued. I want to be fair to these gentlemen, and I am fair. But I doubt whether it is just the thing for them, in this present uncertain state of our knowledge, to stand as they do, utterly oblivious to any decent attempt to do anything, to relegate that all to the shades and simply conclude, as a matter of *a priori* inference, that this thing cannot be done, and therefore drop the whole business.

I would like to raise another question. I would like to ask the gentlemen from around the neighborhood of New York city

whether, if they had been really active and alert and on the firing line when this thing was discovered in 1904, might they not have accomplished some real thing which would have redounded to the benefit of the other States, as Massachusetts has done in her gypsy moth fight? (Applause). If instead of sitting down and nursing their hands in idleness and allowing this scourge to go on, simply because they could not originate sufficient interest in their States, they had gone out and done what they could, this thing would probably not have come upon us. The assumption is quite as valid as many we have heard from the other side.

Now Mr. Chairman, in work of this kind I think it just and right that those who are interested in it should all pull together. If we do not agree upon methods, if we are not agreed as to our conclusions, why not each work out these conclusions for himself? Why not each interested person, State, or organization, endeavor to do what he or it can? We would regard it as our everlasting shame and disgrace if we had sat down and permitted this disease to sweep on without raising a hand against it. We have the finest kind of illustrations of success in work of this kind. Did the United States Goverment cease to pursue its investigations and its practical work in the eradication of yellow fever simply because it took a hundred years to get to some tangible result? Finally they have solved the yellow fever problem. They have done it with the aid of the scientist, and we welcome his effort, but we want it to be on scientific grounds. New Jersey has been plagued with mosquitoes since time immemorial, I presume; but have the citizens of New Jersey ever failed to screen their windows against mosquitoes because the scientists of the State have not succeeded in working out a method of eradication that is effective? There is a lot of homely illustration of effort where we are engaged in doing what we can in an endeavor to find out something that will be really useful, tangible, and effective.

That is the keynote of our work here. I would like this Convention to carry away with it the idea that we are in this work just for what ever result we can accomplish, and we do not care in what direction the inquiry goes. That makes no difference whatever. What do we care whether this fungus went on a

foreign trip some years ago and then came back in disguise and is now setting up business at the old stand? The thing is with us, is before us, and we want to deal with the concrete present. The other is interesting historically, but let that be as it may. The thing to do is to deal with the problems that are with us; and when we have dealt with them to the best of our knowledge and then failed, we have used our whole effort and I think we have discharged our duty to the public. (Applause).

PROFESSOR SURFACE: Mr. Chairman: I should like to direct our thoughts to a subject which I think has, in part, escaped our attention in discussing the excellent paper of Dr. Hopkins. He has brought our attention to the fact that there are four hundred and seventy-two species of insects known to attack the chesnut tree, and a great number of these are borers. He has brought our attention to the fact that those borers make two holes in the tree, one as the young larva forces its way in and one as it comes out as a mature beetle. It has been shown that the fungus germ or spore enters where the bark is injured or punctured. Thus we see that each insect boring in the tree makes two places of injury where the spore germs can enter, and thus it makes a possibility of damage at two places, although as a rule they are not far apart. Now let us remember that the natural and chief enemies by all means of these borers are the woodpeckers, and the natural enemies of these four hundred and seventy-two species of insects are the birds of the forest. It has been said that the woodpeckers carry the disease germs; but let us not infer for a minute that the woodpecker should be exterminated for so doing, for, were all the woodpeckers utterly destroyed, there would practically be just as much dissemination of these disease germs as if the woodpeckers were all present. These germs are carried readily by the wind. In the same way the robin, for example, has been accused of spreading the San Jose scale. If all the robins were destroyed the San Jose scale would be carried just as much as if the robins were present. The fact that in passing from one injured place to another there may be some germs on the bill of the woodpecker does not argue against that beneficial bird of our forest. I wish to go on record as saying that one of the most efficient

methods of fighting this blight is to preserve the birds and particularly the woodpeckers, which destroy these borers. I have before me sections of branches that have been bored by insects and woodpeckers having been taken out, showing their beneficial work. It appears to me, then, that the impression should be corrected as to the possibility of preventing the spread of the germs by destroying woodpeckers. Preserve the woodpeckers and other insectivorous birds and prevent the spread of the infection. (Applause)

DR. MURRILL: Mr. Chairman: I have been accused of using "pre-Convention methods." I had no intention whatever of that purpose. I am not a politician at all. When I got back from the Pacific Coast I found there had been a Convention or a Conference, in Albany, and I found that New York State, my own State, had made certain recommendations for an appropriation. I deemed that unwise, that is, to ask for a large appropriation, so I immediately took steps to write to the Governor and to write to some of the representatives and I took the matter up, entirely as a citizen of New York State. It was my duty to the State. Later I heard something about an appropriation in the Legislature of Virginia, my native State, and at once took the matter up with the Governor of that State. It is a copy of this letter which the speaker before (Mr. Williams) had for discussion.

As to sitting down and doing nothing, for twenty years I have been working on diseases of trees. For the last seven years I have known this fungus. Immediately when I found it, when the affected trees were shown me by Mr. Merkel, I began the most industrious investigation of it, and I venture to say that many of those present have been guided to a knowledge of it through my extensive correspondence on the subject.

Now for a programme, I have that also. I do not believe in butting our heads against a wall and wasting the public money uselessly. I believe in carrying on investigations a little further and, if possible, in finding some rational method, so that we can use our funds to much better advantage. I should say, keep in touch with the disease in every stage; survey and locate it, but do not locate it with reference to eradication, because I deem that impossible. Devote this year, at least, to scientific in-

vestigation. The papers of all the delegates have referred to being on the eve of some great discovery. Now let us give them another year and let the Commission devote its best energies to scientific investigation along certain lines which I have here marked out, which may be used if you wish them. I will not read them.

(The speaker handed a paper to the Chairman, which appears later on the record of proceedings).

Let them be forest tests, and also orchard and laboratory tests. Those forest tests may embody your immune zone, your eradication of diseased trees in a section. Let that be a scientific, thoroughly scientific test, under this Commission, and, after the season is over, let us have a report and decide what further must be done with this magnificent appropriation which the State of Pennsylvania has so generously made. (Applause).

PROFESSOR RANE: I simply rise just to make this point: It seems to me that a discussion is what brings things out. Now I am sure everybody that is attending this Convention at this time feels that the State of Pennsylvania is taking a splendid stand in this work. I am also of the opinion that some have allowed the little financial end to step in, thinking perhaps that the State of Pennsylvania is throwing away some money. After all, this is insignificant. I feel that the responsibility upon a Commission that has money to expend in this work is likely to bring those men out, and put them in a position that we will all look forward to, and we cannot secure this unless that responsibility is placed in such a way. I think that is the beauty of the gypsy moth work in Massachusetts. We have had a great deal of money. When it was placed under my Department, I wondered how in the world to spend that amount of money and really derive the most benefit from it. That was the problem that worried us most, and I doubt not that is the same problem that is worrying this Commission most. I am sure we are not here in any way to criticize, and I hope at least we do not fall into that attitude of mind. I am inclined to think that some have the wrong impression. We are heart and hand with this Commission in Pennsylvania, and I believe that with money and with responsibility, they are likely to bring things about. We have brought results about in the moth work in my state in improv-

ing spraying machinery alone that I believe will be sufficient importance in the future to the whole broad United States to pay for the expenditure. Also, no one could estimate the value to the world of the use of arsenate of lead for spraying purposes, for which the gypsy moth work in Massachusetts is responsible.

Again, another point that I wish to emphasize. We are establishing positions, State Foresters and other State positions along different lines. I think that we want to get into the habit of having a well directed forest policy, so that the current may flow along well defined channels. The great trouble I think, as I look upon these forest pathologists and entomologists is that there are constantly new outbreaks in new places, and a few good specialists on each problem are better than each state working it out independently.

I should like a system, and it seems to me that the State foresters, if there is such a position in our various States, ought to be closely knit together and that this work should go along that channel and be well directed, not only, as I brought out, for these individual things but for the problem as a whole, so that in the long run we will get definite results.

MR. STEVENS, of the Lehigh Valley Railroad: Mr. Chairman, it is now three o'clock on the last afternoon of this session. I came here for two purposes: One, to get additional information regarding this fungous pest, and another, to get some idea of how we can best co-operate in combatting it. Now a large share of this meeting has been given up to one side, the analytical side of the question, and it seems to me we should give some attention to the constructive side. We are agreed in some things, and one is, that a better system of forestry, carried out through the East, will tend to control or help control this fungous disease. I think there is no dissenting voice on that at all. This has been the the history of a good many pests which we have met. I have in mind particularly such a one as the orange pockweed.

"The Devil's Paint Brush." We may not have known how to eradicate it, but the introduction of that weed has brought about a better rotation of the crops, which makes orange pock-weed a negligible quantity. So it seems to me here, if we could appoint a committee or in some way formulate a plan for a more rational

control of our forests, we would be doing something upon which we could agree and work together, and thus not only control this fungous disease, but do wonders to the forests of this section.

THE CHAIRMAN: Mr. Stevens will probably be pleased to learn that the Committee on Resolutions will have something of a constructive order to suggest.

MR. STEVENS: Then may we proceed as quickly as possible, so that we may discuss that?

THE CHAIRMAN: That is the next order on the programme, and before calling for a report by the Committee on Resolutions, if you will permit a word from the Chair, I will beg your indulgence. A few moments ago, doubtless in a spirit of fun, the word "politician" was introduced into our discussion. Now I wish to say that I have made careful observations --as one may of the work in one State from another State— of the work that is being done in the State of Pennsylvania along this line. Thus far I have failed to see the first sign of what might be regarded as political methods, and I claim to be somewhat expert in detecting the presence of such methods. (Applause). I have inquired of two gentlemen of Pennsylvania who are well posted, one of them being a member of the Chestnut Tree Blight Commission, as to the political faith of these five men, and I have been unable to find out yet what their political faith is. (Applause).

The members of the Chestnut Tree Blight Commission of Pennsylvania are serving without compensation. They are men of large business interests and also altruistic interests. They are glad to give their time to the subject because they believe they can help the State to solve a great problem, and, so far as I have been able to size up the situation in Pennsylvania, from the papers and the discussions which have been offered here, I should say that the Pennsylvania plan, in a word, is to seek the truth and when the best course is found, then to follow that course. What else can we consider to be the policy in this State? Remember that the Legislature of Pennsylvania has appropriated two hundred and seventy-five thousand dollars, and we heard yesterday that only twenty thousand dollars

has been expended. That money is being used, it appears to me, to determine which of various methods is the best, and the very fact that such a large balance of the money is still held in reserve is the strongest proof that the authorities of this State are waiting until they are fully satisfied as to which is the best course to pursue. It seems to me, gentlemen, that when we say there is danger of wasting public money uselessly in connection with the work which has been reported here, we are attacking a phantom and, as I think there is some little danger of the wrong impression getting out from this meeting, I desire to make these remarks to assist in clearing up the situation. Good work is being done in this State and in other States. Here the problem is perhaps greater than in any other State, and here the State has made magnificent provision for both studying the problem and carrying out effective measures. (Applause).

DR. MURRILL: I just want to concur heartily in everything the Chairman has said, and entirely disclaim any reference to the Commission in any way or any shape that the Pennsylvania State Legislature has so generously provided for. I just wanted, when called a politician, by using pre-Convention methods, to disillusionize you of that statement.

PROFESSOR CLINTON: I used that word "politician." Why did I use that word "politician?" Not because he is a Democrat or a Republican or anything of that sort—I do not care what his politics are—but for this reason: The convention at Albany and the convention here, to my mind, is called largely for a moral backing for this Chestnut Blight Commission in Pennsylvania. They want that backing and they are going to get it, and I am not going to object to it. You can pass any resolution you want, and I will not object to it. I came down here to present facts as I know them and to give them to you, and the moment Mr. Williams is speaking, he is trying to throw slurs at science, and especially at science outside of Pennsylvania. He attacked Professor Peck, and Professor Peck at Albany was the one man that—not the one man, but he was a man—that said he was in favor of their work in fighting the chestnut blight. He quotes him to disparage him, and he is the

man that is backing up their work. Professor Peck is a good scientist in his way. There are a lot of good scientists that are doing good work outside of this State, as well as in it.

THE CHAIRMAN: We will now proceed to hear the report of the Committee on Resolutions.

MR. WILLIAMS: I would like to preface the report by saying that I have no intention of disparaging any man.

What I said was not with that intention in mind, but to call attention to what I claim are inadequate methods, methods not well thought out. I have no quarrel with any man whatever. I admire a good, lusty antagonist, and I respect his opinion. I am also most profoundly grateful that we have had an explanation from our good friend, Dr. Murrill, as to just what his programme is. We have wondered a long time what it might be and we are in the dark no longer, now that he has made the explanation; and we are glad for it.

In presenting the resolutions which have been drafted by your Committee, appointed for that purpose, and as the Chairman of the Committee, it becomes my duty at their direction to report as follows:

WHEREAS, This Conference recognizes the great importance of the chestnut tree as one of our most valuable timber assets, having an estimated value of not less than $400,000,000; and

WHEREAS, A most virulent fungous disease has made its appearance in wide sections of the chestnut timber region, and already many millions of dollars of damage have been sustained, and the total extinction of the chestnut tree is threatened by the rapid spread of this disease; and

WHEREAS, We recognize the importance of prompt action; therefore, be it

Resolved, That the thanks of this Conference are tendered to Governor Tener for calling it, and for the courtesies he has shown.

That we appreciate the interest of the President of the United States, as evidenced by his communication to Governor Tener, showing, as it does, that the head of the National Government is not unmindful of the great danger presented by the Chestnut Blight problem.

That the Commission appointed by the Governor of Pennsylvania be commended for the earnestness and diligence they have shown in the conduct of their work.

That we urge the National Government, the States, and the Dominion of Canada to follow the example of Pennsylvania, which is analogous to that of Massachusetts in starting the fight against the gypsy moth, and appropriate an amount sufficient to enable their proper authorities to cope with the disease where practicable.

That we favor the bill now before Congress appropriating $80,000 for the use of the United States Department of Agriculture in Chestnut Bark Disease work, and urge all States to use every means possible to aid in having this bill become a law at the earliest moment.

That we believe trained and experienced men should be employed in the field and laboratory to study the disease in all its phases.

That we believe definite boundaries should be established where advisable, in each State, beyond which limits an earnest endeavor should be made to stamp out the disease.

That we believe an efficient and strong quarantine should be maintained; and that it should be the earnest effort of every State, the Federal Government, and the Dominion of Canada to prevent the spread of the disease within and beyond their borders. In accord with this thought we strongly commend the efforts being made to pass the Simmons bill now before Congress.

That we believe strong efforts should be made in all States to stimulate the utilization of chestnut products, and in order to do so, we recommend that the Interstate Commerce Commission permit railroads and other transportation companies to name low freight rates so that chestnut products not liable to spread the disease may be properly distributed.

That we recommend the National Government, each State, and the Dominion of Canada to publish practical, concise, and well illustrated bulletins for educating owners of chestnut trees.

That we believe further meetings on the line of this Conference advisable and we hope the Pennsylvania Commission will arrange for similar meetings.

That we thank the State of Pennsylvania for its intention to publish immediately the proceedings of this Conference.

That copies of these resolutions be forwarded to the President of the United States, to the Governor of every State, to the Governor General of the Dominion of Canada, and the members of the Federal and State Legislatures, with the request that they do all in their power to aid in checking the ravages of this dread disease.

I respectfully move the adoption of the resolutions.

Seconded by Dr. J. Russell Smith.

THE CHAIRMAN: Are there any remarks?

DR. MURRILL: Possibly I have taken too much of your time, but I have a message to these delegates of the other States, and I feel sure that they are willing to listen to me for two minutes. The question is, what will you say to your States when you return? What programme will you recommend in your States? First: Survey to keep in touch with the progress of the disease, so that you may be able to acquaint timber owners just when to cut and utilize their timber to the greatest advantage. The State should have this knowledge. Then also pay heed to science and further investigation.

THE CHAIRMAN: What you are giving is undoubtedly of great value, but it occurs to the Chair that it is not directly in line with these resolutions, and the Chair would ask if you would not be willing to bring it up after we have acted on the resolutions, unless you have something in mind further than has been developed. Is there any discussion of these resolutions?

The motion to adopt the resolutions was put.

THE CHAIRMAN: The resolutions seem to have passed. They have passed.

DR. J. W. HARSHBERGER, of Philadelphia: Mr. Chairman: Just one suggestion that I want to make that has occurred to me during the proceedings, that I think is in line with

suggestions looking toward some practical outcome of these meetings. We, as wise men, should provide for any contingency that may arise in future years. If the chestnut tree is doomed, then the fungus which attacks the chestnut tree is doomed with it. My suggestion is this: That the Chestnut Blight Commission send to some out-of-the-way part of the world, where the chestnut tree will grow, nuts which have been thoroughly sterilized, with a suggestion that these nuts be grown under the care of some forester; you might say in southern Germany, or eastern Germany, wherever they think proper, in case that the American chestnut tree is exterminated by the chestnut blight in America; so that we can draw upon that supply to re-forest our hillsides and our slopes with our native chestnut tree. Just as the man in the western states provides his shelter against the cyclones, so we should provide a means of re-stocking our forests with the chestnut tree, by sending these chestnuts to some out of the way part of the world, which is immune, or where the chestnut blight disease will practically be cut off from reaching the chestnut trees. That is merely a suggestion, in line with future operations connected with this blight disease.

THE CHAIRMAN: The Chair should have extended an opportunity to Professor Murrill at once, after passing the resolutions, for his statement.

DR. MURRILL: Just a minute, and I will feel that my duty will have been done: The State's programme, then, would be, first, to survey, to locate, and keep in touch with the progress of the disease, not a rigid inspection, but such an inspection as the State Forester and State Pathologist could take charge of, possibly with a slight appropriation. Second, await results of scientific investigation for one year at least. We are having a magnificent experiment here, one we are glad to have made along scientific lines, and under the leadership of a Commission above reproach in every way. Now, can we not wait a year and continue our experiments and then act upon the evidence that we get from this year's work?

Just a word to timber owners: Forest management is not a cure for the chestnut blight. The chestnut blight is a good feeder. The better the chestnut tree, the better it grows on it.

It is a mistake to say that forest management will eradicate blight. It will eradicate most other diseases, insects, and so forth, but it does not affect the blight.

Utilization is the real issue; the practical use of the lumber, and that is in the hands of those who own chestnut timber. The present is yours. You have the chestnut timber as it is; tomorrow, next generation, you may have it not. Be business like and stand for your own rights. The opinion of one man may be worth a thousand times the opinion of another. You see that in every walk of life. Take the opinion of hardheaded, scientific men, who know about this trouble, just as you would the opinions of hardheaded business men. I thank you for your at tention. (Applause).

THE CHAIRMAN: If there is no objection, a statement prepared by Dr. Murrill upon "Questions for Scientific Investigation," handed in to the desk a few minutes ago, will be including in the proceedings, together with his personal views.

The paper submitted is a follows:

QUESTIONS FOR SCIENTIFIC INVESTIGATION.

1. The viability of the spores, both summer and winter forms.
2. The vitality of the mycelium in the bark and wood.
3. The vitality of sprouts and their bearings on the question.
4. The food of the fungus; the decomposition of tannin by ferments.
5. Distribution. A large subject, involving experiments and observations over wide areas and dealing with winds, rain, insects, birds and their migration, squirrels, the transportation of wood, railway ties; rate and direction of distribution; nursery stock; trees in foreign countries; effects of coppicing.
6. Origin. Nothing is known at present. Is it native or foreign? Why was it unknown until recently, and then why so violent?
7. Will it attack other trees besides species of chestnut? Much depends on this. Trees nearest the chestnut should be used for experiment.

8. What is the future of the disease? Will it run its course and disappear? Will it become less virulent? Will resistant varieties appear? Can such varieties be made by selection, hybridization, etc.? Can chestnuts be grown with safety beyond the Mississippi river? How long after death of all our trees, may chestnuts be again planted with safety?

9. Can we expect natural enemies to arise? If it were an insect disease, this might be looked for with more hope.

10. Can a method of control be discovered by further scientific research? Most remedies suggested by unscientific persons are known at once to be valueless and need not be tried. One thing is certain, the more one knows about a disease, the more liable one is to discover a remedy. If none is possible, the sooner this fact is known, the better for all concerned.

THE CHAIRMAN: It has been suggested to the Chair from two directions that, as we have in this audience a number of men of large commercial interests, the opportunity should be extended to them to make remarks. The Chair is pleased to accept that suggestion. Mr. Thalheimer.

MR. THALHEIMER, of Reading: Mr. Chairman: In Pennsylvania, in those counties that I know, most of the farmers have five, ten, and some of them fifteen acres of timber land that has come away back from their forefathers, and I think it would be proper for this Commission to get the names of those farmers, or their representatives, and keep them posted on how to take care of their timber and caution them of the danger they are in of losing it, and let them assist you in looking after it. Attract their attention, and you will get many good points for this Commission to act on which you would not get otherwise.

If you will allow me one minute, I will tell you something which I observed myself. It may be interesting to some of you. I stopped off at a corner of a lane to wait for a car and while I was waiting, I looked on the ground and there saw gypsy moths. I never saw them as large in my life. They were yellow and blue with big horns, worse than the Massachusetts kind. They were about two inches long and about a quarter of an inch thick. They walked along the track, and I looked at them and followed them. My car came along, and I went down town and

coming back, while waiting for another car, I wanted to take a seat. There was a walnut tree at the corner of the lane, and I wanted to take a seat on a bench under the tree. When I came to take that seat, it was literally covered with those gypsy moths, coming off of that tree. What I want to say to you is this: I watched and noted that there was a little fly, which is like a comparison of a guinea hen to an ordinary chicken—they were just that shape—and one or two would follow a moth and they would get on top of the moth and just sting it and jump off again. I kept on investigating, and it took me two hours to watch them. As soon as they would touch the gypsy moth at a certain place back of the neck, they would kill it every time. That was an accidental investigation. I spoke to several professors about it, and asked them to look it up, and see whether they could not propagate that fly.

MR. STEVENS: Where was that?

MR. THALHEIMER: In Reading, Pa.

MR. STEVENS: May I ask Dr. Murrill a question? He made a statement that good forest management would not help to control chestnut blight disease. I would like to ask his authority for the statement.

DR. MURRILL: My own experience about New York State, over a wide area, for several years.

MR. STEVENS: In forests?

DR. MURRILL: In forests, over dense, almost full grown chestnut forests. The disease occurs without reference to ill or well trees, and I have noticed it on vigorous trees as well as on trees diseased from other causes.

PROFESSOR RANE: In construing that term "forestry management," it seems to me it might go further than just applying it to chestnut trees. As a matter of fact, our forest management as regards the moth situation is to eliminate those trees and bring in others that would take their place. Forestry management means, therefore, the elimination of the chestnut with the idea of bringing in other species; so we can bring that thing out in a practical way, from a different standpoint than just thinning the chestnut.

DR. MURRILL: I heartily commend that.

MR. CRAMER, of Lehigh University: In reply to the gentleman at my right, Dr. Murrill said his observation was based on many years' experience of his own in and about the forests. I would like to submit the question to this gentleman as what those experiments were,—actual work, or scientific experiments, actual work in removing these infected trees, or examining them?

DR. MURRILL: Both. We tried various experiments. When the disease first appeared, we tried the cutting off and cutting out, but not the cutting of the stumps. Some of the stumps were burned, and we found that the sprouts sprung up from several inches below the ground and that the disease went into the roots some distance. It also went beneath the bark into the wood and re-appeared, so that it was impossible to cut it out. We have had a number of observations and experiments about New York to show that forest management, so far as clean culture goes, has no effect whatever on the eradication or on the control of chestnut blight.

MR. ZIEGLER: I am concerned with the management of about twenty thousand acres of forest, which is largely chestnut coppice. I want to tell you about a condition existing there, and to ask Dr. Murrill's opinion as to what should be done. We have chestnut blight in those twenty thousand acres in about ten spots, the largest of which is about ten acres, existing there for two years. The first year's attack killed merely a few trees here and there. The second year's attack shows the death of trees in a radiating direction from the central focus, you might call it. I would like to know what action should be taken; whether he would recommend cutting out these few acres at once and thereby trying to reduce the number of spores produced, to the degree of say one one-hundredth, at a very small cost, or whether he would leave those trees go a year longer and await some other measure?

DR. MURRILL: I have received hundreds of letters of that same nature, and now I must answer all of them in this way: To save, utilize, and market your timber is the first considera-

tion, when the disease has entered a forest of that extent. Therefore, cut your timber that is likely to go to waste first. Cut it first, if favorable, and later, as the disease encroaches, cut other timber and use it and market it, so that you may not glut the market.

MR. ZIEGLER: May I suggest that that is practically along the line that is being followed by the Penna. Blight Commission, so far as I have been able to learn of it, and that is the line we hope to follow, following their advice.

DR. MICKLEBOROUGH: Dr. Murrill, have you been cutting the chestnut growth up at the Bronx Garden?

DR. MURRILL: We are now cutting down the last trees. It has cost us five thousand dollars to cut down fourteen hundred trees in fifty acres of the Bronx Park.

DR. MICKLEBOROUGH: I would like to ask Dr. Murrill another question, and that is, in the early stages of the disease on western Long Island, where it is in the most malignant form, if it was not his suggestion to the Park Commissioners in the autumn of 1907 or 1908, on account of the prevalence of the disease in Prospect Park where there were twelve or fifteen hundred chestnut trees, and if you did not also recommend to do the cutting there?

DR. MURRILL: That has been my recommendation, Mr. Chairman, until we found it was hopeless, and the area of the disease was so great as to make it practically impossible to cut these trees. We have not been able to get money enough appropriated by the Parks and public in New York City to cut out the dead wood caused by this disease.

Mr. E. A. WEIMER, of Lebanon, Pa.: Mr. Chairman and Gentlemen: I would like to address a few unscientific remarks to the owners of wood lots or forests, and if my scientific friends wish to listen, they may.

I have been interested in forestry for twenty-four years and have made a study of the chestnut blight during the past four years. I think that I have the honor, with the Hon. Mr. Elliott, who is here, and Dr. Drinker, in discovering the first entry of

the blight into Pennsylvania. I have here in a jar a sample of that very first specimen, three and one-half years old. It has been sealed ever since, I am told, and it shows living or active spores. I show you this to demonstrate the care that is necessary to take in getting rid of the refuse of the trees and their bark when we go to cut them down.

To land owners I wish to say that I have myself a tract of chestnut timber in Lebanon county. The trees there are forty-one years old and they will range all the way from forty to ninety feet in height, and from ten to twenty inches in diameter. This tract of land shows every condition, you may say, of altitudes, of moisture, and of soil conditions. It has a north, south, east, and west exposure, because it is in the shape of a horseshoe. It has an altitude of eleven hundred feet at the highest part and at the lowest of seven hundred feet above sea level. It also has a stream running through it which gives you a swampy portion. Up at the top it is very gravelly; on one side it is clay, and on the other side you will find some of the best of wheat land. In every one of these sections I have found focal centers of blight, making this tract a perfect field for study.

Here I want to call your attention to one thing that has just come to my mind: Do not depend on discovering blight from surface indications only. The inspectors and myself have gone through my tract several times, and we thought we had discovered several trees only with the blight in its advanced stages, and a small number of other trees showing only traces.

Two weeks ago, however, the Forestry Department asked me to cut two carloads of blighted wood to demonstrate to the extract manufacturers that the blight had no effect on the production of tannic acid. So we went out to my tract, and Mr. Wirt and Mr. Fox of the Forestry Department, helped to locate trees. After going through the tract and locating only two focal centers of about twenty-five trees, we commenced to wonder where the two carloads, twenty-seven cords, were to come from.

I then suggested to Mr. Fox, who remained on the job, that we start cutting down the trees around the focal centers, and, if we found trees not infected, we would throw them aside. We started cutting and chopped down an acre of trees that showed few signs as viewed from the ground, but when cut down, we saw

that their tops were badly infected; every one in fact. This shows that when you find a focal center, it would be advisable to keep on cutting all around the focal center until you have taken every infected tree, and not to depend on surface indications.

You may look at the stump with a microscope and you may not find any spores; for I will tell you that I have hunted for surface indications of the blight for the past few years in my tract, and never found indications of the bark splitting or spore dust at the roots or base of the stump, until last year, yet the tops of the trees, in certain sections, are all dead; they started dying several years ago.

I want to say one thing more. The farmers can help the Pennsylvania Chestnut Blight Commission by starting to do some of the work of inspection themselves, and if in doubt, may call on the Commission for advice and information. The Commission is willing to send men out to help you to locate the blight and tell you what to do. I will also try to help you, or, if you will send your foresters to my tract near Mt. Gretna, I will try to help them.

I have discovered a new way of finding the blight which I wish to present to this body for what it is worth. I want to tell you how you can see the blight even ninety feet in the air on what we call top-infected trees. You place your back directly towards the sun, half close your eyes and then look up along the top part of the tree, and if there is any blight in the cracks of the bark in a direct line with the rays of the sun, you will find the yellow spores highly illuminated. Under any other condition you would not see these spores, as they would be hidden by the shadows cast by the bark. Now, say in two hours, after the sun has illuminated another portion of the tree, you had better go through that tract again. In other words, start out going through the tract by one route so planned that during different times of the day you will have passed the same tree several times, and each time place the sun directly back of you, and you will be surprised with the results. I think Mr. Fox, (if he is here), will verify what I have said. Both of us spent three days in inspecting an area of trees, and did not find an infected tree. But, one morning, on that coldest day we had for

years, two weeks ago, I got up at six o'clock, and found over seventy-five trees by this sun method in a place that we had gone over three times before, and we were truly surprised.

I notice that some of the experts are laughing, but I will wager that I will take anyone to my tract, and they will pass by the trees referred to as uninfested. I will then cut these trees down and show them the blight.

These trees are just as dangerous as the trees infected with the blight from top to bottom. If you think you do not have the blight among your trees, sacrifice a few trees that look suspicious, and the chances are that you will see it on the top branches. If it is possible to get up on some high point overlooking your forest, and you notice brown or yellow patches of tree tops, go and cut the trees down in those spots whether you see the blight or not. Take no chances, because it is a disease that you can take no chances with.

I want to tell you another thing. We may not be able to control the blight by cutting down the trees, but it is worth while taking the chances, and all these men who have property, I think have money enough to take the chances. I would advise cutting down the trees quickly in the forests. Do it tomorrow, because winter time is the best time. The spores are in their winter quarters and are less likely to be blown around. Cut them down, bark them and, if possible, try to burn up all the leaves and brush in the infected areas. If necessary, sacrifice that area. Put all the branches and bark over the stumps and spray them with coal oil or better, cheap crude oil. Buy one of those cheap sprayers, costing about six dollars, and atomize the oil. You will find that a few gallons will cover a number of stumps and enable you to burn the stump down to the ground. It will kill all the spores and borers. On the first application of the heat, the bark peels away from the stump, and that presents the spores and borers to the flame where they are destroyed at once. Burning the stumps is better than peeling them, because when you peel off the bark, you lose some of the bark or shake the spores out on the ground.

This bottled specimen which I have shows that the spores will live three and one half years. This should show you the necessity of killing all the spores possible.

Here is one benefit of the Chestnut Blight Commission's work. They propose to cut down the infected trees. It may not stop the blight, but one thing it will do. If they burn the stumps, it will produce the best possible new condition for the managing of that forest. Even if the blight does come back on the sprouts, you can work on the sprouts and cut them off the second time, if necessary. You can also spray the young growth with lime-sulphur solution for the fungus, and apply some other solution to be discovered for the borers. It will also teach us the true value of chestnut wood.

I think our chances of controlling the disease are good. I do not say or believe that we are going to kill it entirely, because, to my knowledge, no spore diseases have ever been completely eradicated. We still have the black-knot with us, as well as the peach-yellows, but they are now both so well controlled that we have almost forgotten them.

We may be able to check the blight to such an extent that nature will be able to supply a means to throw off the disease in due time, especially if we aid her by killing the borers and limiting the supply of spores. So, again I say, I believe the Chestnut Blight Commission is on the right track, and my forest preserve is open to any man interested in this work.

My address is E. A. Weimer, Lebanon, Pa., and I will say to any man who comes to Lebanon, I will show him all I can; every condition of forestry that has developed on my tracts from over twenty-four years of practice. (Applause).

PROFESSOR COLLINS: The statement was made that this specimen in the bottle had been sealed for three and a half years, and the spores are still alive, as I understood it. I think Mr. Weimer forgot to tell how he knew they are alive.

MR. WEIMER: You can see in the lower part here (exhibiting bottle), that the spores have become very active. They retain their red color, whereas, up here where they are dead or dormant, they turned black, and have fallen off. I think that is the best indication that I can offer. These indications were thought good enough for my purpose.

PROFESSOR COLLINS: I think the observations would be

a little more conclusive if the gentleman would try cultures to see if they would grow.

MR. WEIMER: I agree with the Professor, and will say that this specimen is now the property of the Forestry Department, and I will kindly ask them to have a culture test made.

DR. MICKLEBOROUGH: May I make a brief statement with reference to the life of spores? I have a little vial with me in which I have the ascospores that I collected at Gladstone, New Jersey, on Memorial Day, 1908. I have examined those spores from time to time, and find they are still alive. How do we know they are alive? We can take, as I have done, a five per cent. solution of pure glycerine, and the spores will sprout in it. These ascospores will sprout and I have examined the sproutings under the microscope,—the mycelium threads. I was performing a miscroscopic test to harden spores for the microscope, to make a permanent mount, and I accidentally found that, instead of hardening the spores, my five per cent. solution of pure glycerine only was food for them and they proceeded to sprout.

Let me remind you that those little pieces of bark that I have in the vial with me in my coat pocket have been kept dry, free from moisture. If they had been out in the forest, or subjected to the climatic conditions which fungi require, heat and moisture both, I am very sure those spores would have been developed and disseminated long ago. They would have lasted perhaps but a few months; but you take them and keep them perfectly dry, and I believe that you can prolong the life of the ascospores, and probably the conidia, for several years.

THE CHAIRMAN: Would it be well, gentlemen, to agree upon a time for final adjournment, so that we may know what we are working toward? I wish also to arrange for the Governor to come in. Would it be well now to set a time for adjournment?

A DELEGATE: I move you that we adjourn at 4.15 p. m.

MR. PEIRCE: I move that the time be amended to 4:30 p. m.

MR. BODINE: I think it was announced at the beginning of the session that we were to be favored by a farewell visit

of the Governor. Should we not consult his convenience before fixing an hour for adjournment?

THE CHAIRMAN: He has stated that it would be agreeable to him to come in at any time.

The substituted motion is that the hour of adjournment be fixed at 4:30.

The motion was seconded and carried.

THE CHAIRMAN: What is your pleasure with reference to appointing a committee to wait on the Governor?

PROFESSOR RANE: I so move you.

Seconded.

THE CHAIRMAN: It is moved that a committee be appointed to escort the Governor into the room before adjournment.

The motion was put and carried.

THE CHAIRMAN: The Chair will appoint as that committee, Commissioner Bodine, of the Chestnut Tree Blight Commission, Dr. Merkel, of New York, and State Forester Rane of Massachusetts, and will request them to escort the Governor into the meeting ten or fifteen minutes before the adjournment, as they find it to be convenient.

DR. HARSHBERGER, of Philadelphia: A very simple test could be made of the vitality of those spores which Mr. Weimer has, by growing them on an ordinary culture medium, and I would make the suggestion that Mr. Weimer send his specimens to the proper person connected with this Commission, and have the test made to ascertain whether those spores he has in the bottle still retain their vitality or not.

THE CHAIRMAN: The suggestion is made by Dr. Harshberger that Mr. Weimer be requested to send the spores to an expert connected with the Chestnut Tree Blight Commission for examination as to their vitality, and, if agreeable, the Chair would suggest that the result of that examination be included in the proceedings of this meeting.

MR. WEIMER: This sample is in charge of the Forestry Department, so that Mr. Williams or Mr. Wirt will attend to that. It is their privilege. I will take it up with them.

THE CHAIRMAN: We will dismiss the matter, then, with the understanding that Mr. Weimer will take it up with the Forestry Department, and if there is no objection, authority is given to include the report of that investigation in the report of this meeting.

PROFESSOR GRAVES: I would like to ask Mr. Detwiler a question about this dead line. Is that going to be delimited by cutting out all the chestnut, healthy and diseased, or is it just simply an arbitrary line? I want to know this for information.

MR. DETWILER: The dead-line which we plan to establish will be maintained by cutting out the diseased trees as located by constant control; and we have not yet considered cutting out all of the chestnut trees, unless the owners are willing to do it. If, upon an explanation of the situation, the owners are willing to do this, we have advised that it be done.

PROFESSOR GRAVES: If this sort of work is going to be taken up by the State, it seems to me it would be a good plan to delimit all areas which contain no chestnuts. I have the honor, Mr. Chairman, to be the gentleman who went through the State of Massachusetts on a motorcycle, as Professor Rane said this morning, and I found a great many areas there which had no chestnuts at all, and some such areas I am sure occur in Pennsylvania; so if you are going to take up this method, it seems to me such areas ought to be marked out and then start west of those.

PROFESSOR NORTON: I desire to make a suggestion. There may be a great deal of chestnut that must be cut and utilized which might possibly over-stock the market. Why could not the chestnut that is beyond the needs of the market have the tannin extracted from it and stored for future sales, either by corporations, individuals, or possibly by the State? I would like to mention another question of a scientific nature that has been suggested and which I think has not been brought out sufficiently. Of course, those who are familiar with fungous diseases understand this, but I believe that a good many people who are not familiar with the nature of fungi would not appre-

ciate it, and that is the question of the difference in the opportunity for its infection where you have destroyed, say fifty per cent. of the infected material, or where you have destroyed ninety per cent. of it or ninety-nine per cent. Professor Stewart spoke of that, but I wish that someone who is familiar with statistics on that could bring it out a little better; whether there would be much difference in the opportunity for infection where you have destroyed fifty per cent., ninety per cent. or ninety-nine per cent. of the infected material? Of course, we understand that where ninety-nine per cent of it has been destroyed, there still would possibly be hundreds of millions of spores in a small area.

PROFESSOR RANE: I have some resolutions which I would like to present at this time:

"Resolved, That the delegates and others in attendance at this Conference desire to express their high sense of appreciation of the many courtesies tendered them by the officers of the Pennsylvania State Chestnut Blight Commission and the Department of Forestry."

It was moved and seconded that the resolution be adopted.

The motion was put and unanimously carried.

PROFESSOR RANE: I have another resolution:

"Resolved, That the thanks of this convention be, and are hereby tendered Hon. R. A. Pearson for his able and courteous way of handling the duties of permanent Chairman." (Ap plause).

MR. BESLEY (in the Chair): Mr. Pearson is too modest to put that resolution, so I take pleasure in putting it before this house, and if there is no discussion,—I believe it is seconded,—I suggest an immediate vote on that question.

The motion was put to adopt the resolution and unanimously carried. (Applause).

MR. PEARSON: Mr. Temporary Chairman, Ladies and Gentlemen: I sincerely thank you for this compliment. I thanked you at the opening of the conference for the honor of being your presiding officer, and I wish to assure you it has

been a great privilege to me. I feel that we have really accomplished something here which is worth while, and I trust that the good that has been done will be recognized more and more as time passes.

There are two gentlemen in the room who, I am sure, everyone wishes to hear from before we adjourn. Several times during our conference mention has been made of the first discovery of the chestnut tree blight, and the name of the gentleman who discovered it has been mentioned several times. I think we ought to ask him formally to come before us, and make a few remarks. I refer to Mr. Merkel, of New York.

MR. MERKEL: I do not know what Mr. Pearson wants me to say; whether he is wishing for blarney or not. I can only say that I came in order to hear the opinions of everybody expressed. I am glad that the resolutions that were adopted were adopted, in spite of the fact that there were some people who did not agree with them. I believe that the work of this Congress to-day is epoch-making. I believe we have advanced a vast step. We have gone further yesterday and to-day by miles than we were the day before. I hope that we can save the chestnut tree. My fondness for trees in general is the only reason that brought me here; but that I should be pushed into the limelight thus,—a modest violet like I am,—was not my intention.

THE CHAIRMAN: Frequently during our discussion we have heard about the need of constructive work. The one man of the entire State, and I dare say the entire world, who has made possible the greatest constructive work against the Chestnut Tree Blight Disease is now in the room, and I must call upon the father of the measure which is responsible for the effective work in Pennsylvania for a few words, Senator Sproul. (Applause).

SENATOR SPROUL: Mr. Chairman and Gentlemen: A member of the Senate is generally safe in the House, and I did not know that anyone in any official capacity knew I had come over here.

THE CHAIRMAN: We all know you.

SENATOR SPROUL: I am very glad, indeed, to have had an opportunity of looking in on this meeting. When the bill was introduced and considered, it was regarded as largely an experiment, and it was thought that probably the State was taking rather large chances in making available so large a sum of money for carrying on a work which nobody at that time seemed to know very much about. I think that, from what I have heard of the results of this meeting, if no other good were accomplished by the expenditure of the money by Pennsylvania, the initiative taken in investigating this very serious question and in trying to devise ways and means to control the disease,—if no other good out of this meeting has been accomplished, I think that the expenditure was perfectly justifiable. I am glad indeed to hear the expressions from the discoverer of the chestnut blight and others as to the usefulness of this Convention, and I trust that the good work will go on, not only here but everywhere where this disease is threatening so much harm. (Applause).

THE CHAIRMAN: A request has been made that Deputy Commissioner Williams say a word before we adjourn, and at the same time advise you how extra reports of this Conference may be secured, if persons wish to have them.

MR. WILLIAMS: I had no intention of speaking again. All I can say is that we hope, and the Commission hopes, to have this report transcribed and published at an early date. When it is printed every person who has registered here, as visitor or delegate, who has come at the behest of his Governor or some institution which he represents, will be sent gratis, through the mails, a copy of this report. Every other person interested in having a copy of the report can make application to the headquarters of the Chestnut Blight Commission in Philadelphia, 1112 Morris Building in that city, and, so far as may be possible, I think their requests will be complied with. Just how soon it will be possible to have this record in print we do not know, but no time will be wasted in the interim.

I do not think I have anything further to say except to add this word: That the Pennsylvania Department of Forestry is interested with all other foresters and all other practical men

and all other scientific investigators, in doing what we can to produce the greatest good. What we are aiming at in Pennsylvania is to get results, and I take it that when this problem is understood by our friends and neighbors, they will equally be anxious to get results. These will be obtained through various pathways and by different means, but it is the favorable result that we are interested in. That is the great goal of all this effort. We would be very pleased to have any of the delegates and friends who are here call at the Department of Forestry. Many of you have been there; probably many have not. You will find it in the north wing of this building, and we usually have open house from seven o'clock in the morning until ten o'clock at night. Sometimes the doors are open all night, so we are ready to receive our friends at any hour of the day or night. I thank you for this final opportunity to say a word to you, and trust that your visit in Pennsylvania will not have been without some permanent result. (Applause).

MR. THALHEIMER: I would like to ask the delegates that are here whether any of them has had any communication with the Italian Government, to find out their success in raising the chestnut.

THE CHAIRMAN: We are going to refer the speaker to the Secretary of the Conference for that information, and he can give it immediately after adjournment. The Secretary is thoroughly informed on the subject.

Although I have been very positively instructed not to do so, I must at this time call for a word, at least, from the Secretary of the Pennsylvania Blight Commission, Mr. Harold Pierce. (Applause).

MR. PEIRCE: Mr. Chairman and Gentlemen: As Secretary of the Chestnut Tree Blight Commission, in behalf of the Commission, I want to thank both you, Mr. Chairman and the members of the Conference, for the close and business-like attention that has been given to the various discussions that have taken place, and while at times there has been great diversity of opinion, yet from that very diversity we trust much practical good may result.

At the request of Governor Tener, the Commission prepared the programme, but in arranging for the speakers it tried to provide for full and frank discussions by both the supporters and opponents of what is known as "the cutting out process," so that every one would have a fair chance of being heard.

If at any time any one has information of value to impart, the Commission will be only too glad to hear from such persons, and we assure you that anything which may seem likely to be able either to curb or cure the disease, will be gladly given a trial by the Commission.

The Commission considers it has been wise to make what has been called a dead line, believing the ravages of the disease can thereby be much better controlled than to allow the disease to continue to spread as it did for several years, without any attempt to keep it within bounds.

At the same time, the Commission intends to do all it can to carry on investigations both in the field and in the laboratory, hoping that in the near future some cure may be ascertained. We, however, believe that if we are to succeed, we must have the earnest co-operation of all the states, for it seems self-evident to us that Pennsylvania cannot win without such co-operation. We therefore earnestly trust every member of this Conference will go from here to his home imbued with the feeling that he will do all in his power to bring about such co-operation. Without that, I fear it will only be a short time before all the chestnut trees along the Atlantic seaboard will be in a dying state.

As far as possible, the resolutions which this Conference has passed, will be carried out by the Pennsylvania Commission, and in closing, I want again to thank you both for the close and businesslike character of this Conference and to urge earnestly that if anyone here learns of anything which may be of value, either in controlling or curing this disease, that he will at once inform us of it.

Messrs. Bodine, Merkel, and Rane then escorted the Governor to the floor of the Convention.

THE CHAIRMAN: Governor Tener, I desire to report to you that during these two days we have been discussing the various phases of the chestnut tree blight. Many valuable points have

been brought out. The main conclusions of the Conference have been embodied in a set of resolutions, duly adopted this afternoon. It has been arranged, through the courtesy of your own State, to publish the proceedings of this Conference, in order that what has been said and done here may become widely known for the benefit of the fight against this terrible tree disease.

And now, Sir, our deliberations have about ended, and it is a privilege, and I deem it an honor, for me to turn back to you the duty as presiding officer of this meeting, as I received that duty from you only yesterday. (Applause).

GOVERNOR TENER: Mr. Chairman, Ladies and Gentlemen: While it has not been possible for me to attend the meetings of your Convention since its opening and to listen to the various papers that have been read or to take part in the deliberations of the meeting, yet from time to time information has come to me, and I have learned that your meeting has in every way been an interesting one and that you all will go home feeling that you have probably learned something from this meeting and from each other.

I hope that the purpose of the convention was sufficient to justify calling you here. Many of you have come at some inconvenience, I am quite sure. Pennsylvania will be very glad,—and I am particularly pleased to say it,—at her own expense, little or great as it may be, to print the proceedings of this conference and to give the report the very widest circulation. I am glad that you have seen fit to come here and to take the interest you have.

I have learned also that at times there was some spirited argument between you, and very often we know that out of a great conflict comes the greatest peace and the best understanding, and I hope that that is the case in this instance.

And now, as you go to your respective homes, I hope you will carry with you a very pleasant thought of this convention and that, in the days to come, your associations here, your deliberations, and all that you have done, will prove a most pleasant recollection to you all. We are glad indeed to have had you in our Capital City with us on this occasion. Now that you are going, I wish you Godspeed, happiness, and prosperity in all your undertakings of life. (Applause).

If there is no further business for the Convention, I will entertain a motion to adjourn.

DR. MURRILL: I move you, Sir, that we adjourn.

Seconded by Professor Rane.

The motion was put and carried.

GOVERNOR TENER: I now declare this Convention adjourned *sine die.*

ADDENDA.

Newport, Perry County, Pa.,

February 21, 1912.

To the Officers of the Chestnut Blight Convention:

I desire to submit a statement in connection with this blighted wood question which is not the professional opinion of any representative of the Chemical or Forestry Department of the State, or any scientist; but is presented merely as the thought of a layman who has had considerable experience in the chestnut wood extract business, and who has conceived the idea that it might possibly, in a way, have some bearing upon matters under consideration by the convention. It is submitted merely as an individual hypothesis, which may be entirely wrong.

W. M. BENSON.

CHESTNUT BLIGHT AND ITS POSSIBLE REMEDY.

By W. M. BENSON, NEWPORT, PA.

In discussing the causes of the chestnut blight perhaps the past experience of the extract manufacturers who make extract for tanning leather, may be of assistance in pointing out the proper remedy.

The chestnut wood received at the extract factories was at first supposed to be all alike in tanning strength, but costly experience proved that wood from good, strong lime, shale or limestone lands is far richer in tannin than wood from soils that are rocky, sterile, and which contain little lime. This difference is so marked that even the workmen in the leach house at extract plants can tell when wood from a lime shale or limestone region is being leached, simply by the unusual increase in the strength of the liquors obtained from such wood. Chemical analyses proved the same thing beyond all question, that in order for chestnut timber to attain its full tannin strength, it must grow on limestone or lime shale soil. This is not a secret of the extract trade, but a trade fact that extract manufacturers want the public to know, as it explains why the extract manufacturer will take wood from one region, but will refuse wood from some other locality, where analyses of the wood, and practical results in the leach house show a wide difference in the yield of extract per cord of wood. It pays better to pay freight for long distances to obtain wood from a lime shale or limestone region, than to buy wood that is closer to the factory, but which has less tannin.

An analysis of the ashes from the extract factory which was made at State College in the Spring of 1911 shows that there is over 40 per cent. of lime in the ashes. The analysis was made with a view of selling the ashes for the potash they were supposed to contain, but the result was surprising inasmuch as the analysis showed about one-third of one per cent. of potash,

while as before stated it showed over 40 per cent. of lime. Is it not a remarkable thing to realize that a chestnut tree wants 120 times as much lime for its composition as it does of potash?

Another fact from the manufacturer's costly experience with the lime in extract liquors is the expense it costs him to keep the oxalate of lime which is leached from the wood from coating up the copper tubes in the evaporating apparatus, or vacuum pans as they are called. Oxalic acid has a powerful affinity for lime, and it is used as a test in the chemical laboratories to detect the presence of lime in a solution. In the boiling down process the lime combines with the oxalic acid in the tan liquors, and it is precipitated as oxalate of lime, and coats the 4,500 tubes of the evaporating apparatus with a coating which has to be removed by hammering it loose. Acids that will eat the lime off the copper tubes will also eat the copper of the pans, so mechanical and other means must be used to keep the tubes free. It is no small job to do this; and while the constant presence of lime in chestnut tan liquors is one of the drawbacks to evaporating liquors economically, the fact of the presence of lime in the liquors is regarded as a good sign of plenty of tannin in the wood.

Now the writer has little or no scientific knowledge of the chestnut blight, further than having seen it and being able to recognize it in the woods, but would suggest for your further thought and consideration, the supposition that it is due to a lack of lime in the soils in which such blighted wood is growing, and that a blighted tree is simply a tree that is in the process of being starved to death for lack of lime. If this is true then blighted wood will be found on soils that are known to lack in lime, and on the contrary the soils where the chestnut tree attains its greatest size and age will be found on analysis to be composed of a considerable proportion of lime.

The map shown in this convention which outlined the area in which the chestnut blight is at its worst, shows the worst affected area to be in the vicinity of New York City, Long Island, portions of Connecticut, New Jersey, and Delaware. No doubt nearly all who attend this convention know of the palisades of the Hudson, and how little lime such a weather resisting rock is likely to have. The sea sands of New Jersey,

Long Island, and the clays soils of the Connecticut Valley, which are made up of the granite erosion of the White Mountains, all yield but little lime. Granite soils yield potash, but our analysis shows that our chestnut tree needs 120 times as much lime as potash. It was brought out at the convention that the place where the chestnut trees attained the greatest age was in Eastern Tennessee, where they grew to the immense size of six feet or more through. If you will take a geological map of Tennesee, and look at the rock formation in the region of Knoxville, you will be impressed with the large area of limestone and lime shale outcrops in that region. Please note that it was also stated in the Convention that there is no blight as far as is now known in the whole State of Tennessee. If trees can be shown there that are 500 years old and free from blight, growing on a lime shale or limestone soil, it will go far to support our supposition that the blight is not so much a dread disease that threatens to sweep away our native chestnut trees, as it is an evidence that blighted trees are merely trees that are starved for want of lime in the soil on which the tree is growing.

It will not take over six weeks or two months to collect samples of soils from every state represented at the convention, and analyze them. If the soil where the blighted trees are growing show on analysis a low lime content, as against a high lime content where the trees grow large, then we will know almost beyond the shadow of a doubt that the blight is most likely to be caused by lack of lime, but in order to fully prove the supposition, *I would recommend that solutions of lime water be soaked into the ground thoroughly around trees known to be affected with the blight, and soak the ground around the trees as far as the branches above extend out. Soak the ground thoroughly for a distance of two or three feet down, so that every root big and little will get a little lime in solution in which shape it is readily taken up by the roots. Then spray the trees above with the Bordeaux mixture as well.* The reason why I recommend lime water solution soaked into the ground, instead of scattering lime around under the trees is this: It is known that the sap in blighted trees is sour; this sourness is not the natural sourness of tannic acid, but an abnormal sourness; therefore every little fibre and rootlet must be fed lime to cor-

rect the sourness of the sap, and cause a normal, healthy sap to flow or start this spring before the leaves come out. Lime scattered on the ground under the trees would do the same thing in time, but it would take months for occassional rains to soak the lime down to the roots.

What we are particularly interested in at this time is to get positive evidence into the hands of the convention officers as soon as possible; hence I recommend the lime water test in order to get quicker and more positive results, rather than the plan of scattering lime under the trees which is less costly than the lime water plan. Water takes up only one seven-hundredth part of its weight of lime; 80 pounds of lime, costing about 10 to 12 cents wholesale, will therefore make 56,000 pounds of lime water, or 28 tons. The lime would cost less than the labor of getting the water, but for the purpose of getting positive evidence soon it is here recommended.

If the tree grows a longer set of sprouts this coming summer than it did last summer, or if the leaves are a more healthy color, then the whole case will have been fully proved that we have a specific for the blight disease, and it will no longer have any terrors for us. We will be able to preserve the trees we now have, as well as cultivate them to advantage wherever we like, if we choose to go to the expense of applying the lime artificially.

From the extract makers point of view, I would like to see the general law proved by experiment that all trees having a high percentage of tannin in their bark or wood, or both, require lime for their vigorous growth. For instance, the bark of the pear tree is known to contain a fair percentage of tannin. If the tree blights, is it due to a lack of lime in the soil? or is it from some other cause? Will the bark of the pear tree show a high percentage of lime on analysis? If this should prove to be the case then the Horticultural Department of the State will be in possession of a valuable fact, and the extract maker will know to a certainty just what localities are the best in which to locate an extract factory, by studying a geological map showing the limestone and lime shale outcrops, and locating all sorts of tannin producing trees that he may wish to utilize in the future. We already know that the bark of the rock oak which

contains 37 per cent. of lime in the ashes of the bark, and there seems to be a general law in nature that tannin bearing trees must have lime in greater quantities than other trees.

The first few analyses of the soils where blighted chestnut is growing will put the Forestry Departments of the states represented at the convention in position to know in a few weeks whether this supposition of a lack of lime in the soils in blighted tree areas is borne out by facts. If it is found to be so, then the costly and irritating job of forcing reluctant owners of blighted chestnut trees into cutting them down at their own expense will have been avoided, and a policy of preservation adopted in its place. The latter policy will be much easier to put in force, as it will have the hearty co-operation of the public, in the generous efforts of the states to assist owners of blighted trees to save them. If the Forestry Departments can be put in possession of a proper remedy for the blight by this single convention, it will emphasize the value of such conventions, and demonstate the wisdom of the legislators of this State, who so far-sightedly made the convention possible by their appropriation.

FIELD WORK OF THE CHESTNUT TREE BLIGHT COMMISSION.

By THOMAS E. FRANCIS, FIELD SUPERVISOR.

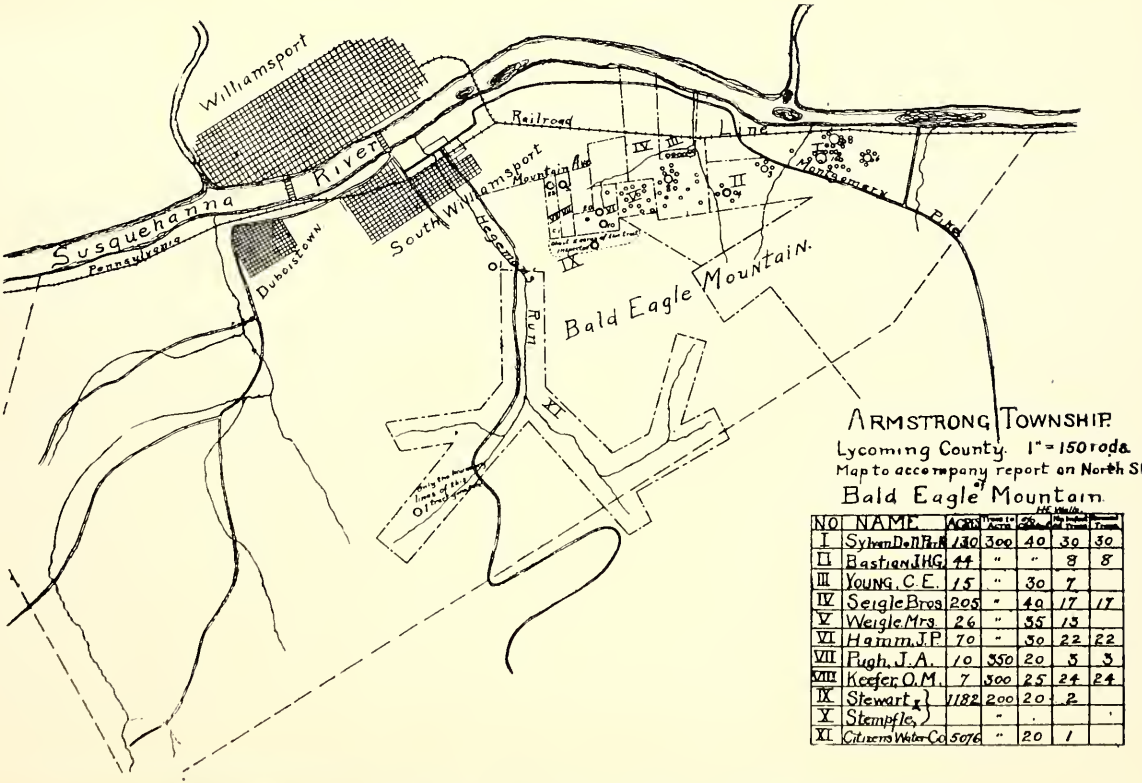
During the six months the field force has been at work, the field agents have been trained and organized, and the general line of western advance determined. Owners of infected woodlots, and the public generally have been warned of the existence of the disease.

The general plan which has been followed is to place one man in charge of the work in a county, under the direction of the field supervisor. The man in charge of the county usually has an assistant, and the two work out from the same headquarters but cover different territory. When one community has been carefully scouted for the blight, the men move to an adjoining district, and in this way cover the county. In the meanwhile, timber owners are interviewed and the subject is

called to the attention of the public by means of field meetings, lectures, talks before Farmers' Institutes, Grange meetings, and the like.

The work from early September until December consisted almost entirely of scouting for the disease. Later in the season, the field agents marked trees for removal and devoted much time to meetings with timber owners in the field, and general educational work. The most important result of our field work, is the interest and spirit of active co-operation we have aroused among the owners of wood-lots in areas where the chestnut tree bark disease has been found. The spirit has been aroused by the activity and honest efforts of our field men. Their inspections have been thoroughly and carefully made, and their talks at local institutes, grange, and special meetings called for the purpose of discussing the chestnut tree bark disease, have been instructive and interesting. These meetings have been well advertised locally and well attended. In Fulton, Franklin, Huntingdon, Bedford, Mifflin, Blair, Centre, and Snyder counties I have personally attended and addressed meetings called by the local field men, at which the attendance ranged from forty to two hundred and fifty woodland owners and interested persons. At these meetings a lively interest was shown, and at every meeting promises of active co-operation and help in locating and eradicating the disease, if found, have been given. Not a single instance of antagonism to our work and methods has come under my observation, and following every meeting, requests have come to us for the inspection of individual tracts, showing that the woodland owners not only approve our methods, but are anxious for an opportunity to do their part in assisting with our work. In fact, many cases of blight have been found and reported by owners as a result of instruction received at these meetings.

Judges, school teachers, ministers, farmers, business men, and prominent men interested in the welfare of the State have addressed our meetings and expressed their approval of our work. As direct evidence of willing co-operation, fifty-seven woodland owners in the previously named counties have removed and properly burned eight hundred and thirty-six infected trees and stumps from December 1, 1911 to February 15, 1912. In



NO	NAME	ACRES	Yield in Acre ft.	Depth to Water Level	Depth to Bed Rock	Thickness of Gravel
I	Sylvan Dell Park	130	300	40	30	30
II	Bastian J.H.G.	44	"	"	8	8
III	Young, C.E.	15	"	30	7	
IV	Seigle Bros	205	"	40	17	17
V	Weigle Mrs.	26	"	35	13	
VI	Hamm, J.P.	70	"	30	22	22
VII	Pugh, J.A.	10	350	20	3	3
VIII	Keefer, O.M.	7	300	25	24	24
IX	Stewart	1182	200	20	2	
X	Stempfle,		"	.		
XI	Citizens Water Co	5076	"	20	1	

Map showing field of special investigations made in Lycoming county, Penna.

every case, an explanation of the object of our work has secured voluntary action on the part of the owners. This is the best evidence that the people of the State are interested, and will accord us the strong co-operation which is essential to carry out successfully the proposed plan of controlling the disease.

A REPORT ON SCOUT WORK ON THE NORTH BENCH OF BALD EAGLE MOUNTAIN, BETWEEN SYLVAN DELL AND WILLIAMSPORT, LYCOMING COUNTY, PA.

By H. E. WELLS, FIELD SUPERVISOR.

In order to determine as nearly as possible the number of cases of infection existing in Sylvan Dell Park and the bench land along the north slope of the Bald Eagle Mountain, a careful inspection was begun at Sylvan Dell. The park land was chosen on account of the assured co-operation of Mr. F. B. Thrall, president of the club, and the members of the Association.

The work of felling infected trees and burning the bark and brush was carefully done, and because of the nearness of the park to the road, many interested persons had an opportunity to see the blight and practical methods of control.

Seventy-five acres of park land were inspected. Twenty-five acres had been previously gone over in a very thorough manner during the last two years, and all dead, dying, or defective trees, together with brush, undergrowth, and all forest weeds, were removed. The result is an open, clean looking, thrifty stand; and, most significant of all, *but one infected tree could be found.* This tree was a large one, fifteen inches in diameter, growing close to the road through the park, and but slightly infected. The remaining fifty acres lie in the eastern part of the park and from a forestal point of view, are in a run-down condition.

No care or management has been given the fifty-acre portion of the park, and the blight, as well as many other fungous diseases, have had full opportunity to thrive unchecked. It was an admirable place in which to study the blight, for it was present in every stage of development. Sprouts, saplings, young

thrifty trees, as well as old, over-mature standards were found infected. The forest floor is mostly rocks, there being little or no soil cover at all. The chestnut runs about 40 per cent. of the stand, with 25 per cent. rock oak, and the remainder a mixture of red, black, and white oak.

The majority of the infections apparently started in the tops. Some trees had to be climbed to identify the infection. In most cases the characteristic appearance of persistent leaves on girdled branches or on infected sprouts below, large lesions or blisters which have girdled the trunk, were sufficient to remove doubt as to whether the tree had blight.

It may be said here that in scout work the closest observation must be given to all suspicious trees, or trees with danger signals. The most conspicuous danger signals in summer or winter are the persistent dead leaves. In summer, these leaves are light yellow in color, in contrast with the healthy green leaves. As they are killed slowly by a gradual stoppage of sap, they remain rather flattened instead of curling and wrinkling as do leaves killed by frost in the fall. Their color is about the same in summer as that of persistent leaves in winter killed by frost and causes other than the blight. This yellowish shade tinged with a greenish hue like that of hay in the mow, often lasts long into the winter. Generally, though, the persistent leaves in winter are of a distinctly red rusty brown color, curled, twisted, frayed, and blown to shreds on the edges. On an infected or girdled branch, the leaves are persistent. In a healthy limb, when sap action stops in the fall, little corky layers are formed at the base of the leaf stem, and the leaf splits off at this point. In a diseased limb, the sap is held up and the leaf is not cut off by the corky layers.

With the leaves, small undeveloped and unopened burs are often seen. In some instances trees are found with almost every bur remaining, closed and nearly full size. The burs are dark in color and blend with the color of the leaves. If the burs are few in number and scattered, especially if open, the chances of blight being present are small.

Another characteristic danger signal is the growth of suckers or sprouts in a ring on girdle below a blister or lesion, extending around the tree. The upward flow of the sap being stopped,

the tendency is to put out these laterals. These sprouts are almost always infected and quickly girdled, so in late fall or winter, a tree with suspicious persistent leaves and burs in the top and leaves on lateral shoots, is very apt to be infected.

As was said, apparently most infection started at the tops of the trees as evidenced by the appearance of the leaves, etc. Yet many large trees were found to be infected upon a careful tree to tree examination, at the base, and the only visible outward sign of the blight was the reddish yellow pustules, forming in the deep fissures of the bark, where the new inner bark is breaking through. Upon cutting into this region, the diseased, discolored inner bark next the wood was found filled with the mycelium of the fungus.

On old trees it takes more time for the disease to appear on the outer surface of the bark in the form of pustules, and often a well defined blister of mycelium is found on the inside of the bark showing no sign of its presence on the outside. For this reason the complete peeling and burning of the bark on the trunk of a tree that is going to be used is essential.

In the inspection work that was carried on, specimens showing the blight in various stages and under different conditions were found, and among them, one in particular is worth mentioning. A large blister nearly a foot in diamter was discovered and a great many of the pustules were rubbed off or destroyed. All over the surface of the lesion were numerous holes made apparently by wood-peckers, probably in search of the insect larvae that are commonly found under dead bark. Is it not possible for these birds to get spores on their feet and bills, carry them to other trees which *may not* be infected, and upon searching in that bark for more insects, thus deposit spores of the blight?

The infections found in the park numbered thirty, *twenty-nine of which are in the part that has been allowed to go without management of any kind.* In the first inspection made of the park last fall only three or four trees were found to be infected. Accordingly, on finding so much infection here it was decided to make a careful strip survey of the bench land lying between the State reserve on the north side of Bald Eagle Mountain, and the Susquehanna river. The tracts are mostly farmers'

woodlots, ranging in size from a few acres up to several hundred acres. The soil is poor there and rocky, and gets poorer in quality closer to the mountain. The stands are in about the same condition as the eastern portion of the park, except where some cutting has been done, and here the brush and growth of forest weeds is very dense. The chestnut runs from 20 per cent. to 40 per cent. of the stand, and chestnut oak is present together with red, black, and white oaks.

In direct contrast with the condition found in this portion of Sylvan Dell Park is the condition observed on the Fish and Game Preserve owned by the Jay Cooke Estate. This property is several hundred acres in extent but only about one hundred acres have been inspected. This portion of the tract is located four miles northeast from Waterville in Cummings township, in the west-central part of Lycoming county. The timber is fully 90 per cent. chestnut and is a clean, thrifty young pole stand averaging six to ten inches in diamter, with 250 trees to the acre. On less than five acres fully thirty trees were found to be infected with blight. The characteristic persistent leaves of last summer were present in every case, but pustules were visible only at a height of ten to twelve feet. As was stated, the trees are unusually healthy and thrifty in appearance and no signs of insect work were found. This center is, at the present time, the most northwesterly infection known.

The map accompanying this report gives the relative size of the tracts, and shows approximately the centers of infection by a cross in a circle. The numerals indicate the number of trees in the center.

The most typical center or spot infection was found on the southwest corner of the Hamm tract (see map). There is timber all around this point, except on the west and northwest. On the west it is cut over, and a young second growth of saplings is present, while on the northwest is a cleared field. The real center of this spot was a large tree about sixteen inches in diameter, infected from top to bottom. The bark was fairly plastered with pustules and all of the young saplings (of which there were three or four growing from the base), were badly infected. It seems reasonable to suppose that this infection has been present for two or three years.

Infections of every kind were found at varying distances from this badly infected tree. Fifty feet away, two saplings, six inches in diameter, were found, upon climbing, to be infected, and the only sign of the blight at a distance was a cluster of dead leaves on a terminal shoot. On climbing, a blister about four inches in diameter was found, but pustules had not been formed, the infection having been caused probably late last summer. This lesion was about ten feet from the very tip of the leader. It was found to be girdled and pustules were present at the beginning of last year's growth.

A short distance away a little to the southeast, a small tree, six inches in diameter, was found infected only at the base. Another tree one hundred feet west in the cut-over area was badly infected. This tree was dead, having been girdled with an axe, and the ring of bark removed; but the blight was fully developed and the bark was covered with pustules above the portion of the tree girdled by the axe.

The largest center was found on the Keefer tract (see map). Here twenty-three trees, all saplings, were found on a circular spot fifty yards in diamter. Only one other tree was found outside this center, and that at the extreme southern end of the tract.

Another center less than a quarter of a mile east from the first center described, was found on the line between Hamm and Stuempfle, and the most badly infected tree was one 10 to 12 inches in diameter, to which the wires of the fence were nailed. The tree was dead, and the tunnels of borers and the larvae in them were found. This tree showed very well the appearance of the blight on old bark, and from it several good sections were obtained. Around this tree the young sprouts and two saplings, four inches in diameter, were badly infected.

The strip was worked, in the manner indicated, and when a center was found, every tree within a varying radius depending on the size of the center was carefully examined until no more trees could be found that were infected. Often at the outer limits of one center the edge of another center would be encountered, and this new spot would be studied in the same way. Here and there, scattering cases of infection were found, not

in a center, though perhaps the source of the infection was one. These are shown on the map as small circles without a cross.

In the same way a careful inspection of the Fisher and Savidge tract has been carried on. Messrs. Fisher and Savidge of Williamsport and Sunbury respectively, have planned to cut off and graft with Paragon scions, the natural stock on 550 acres of land located one mile west of Essick Heights. This land is admirably adapted to the optimum growth of chestnut, and in fact, in some portions of the tract, which comprises in all 640 acres, nothing else grows. The stand is dense young sapling sprouts 12 to 15 years of age, though here and there patches of old mature timber are found. The purity and density of the stand, however, without a doubt accounts for the number of infections present, which exceeds greatly any condition heretofore found in Lycoming county.

The first spot or center was found not over 100 yards west from the house of G. H. Newman (on map), and it is definitely known that summer before last wild doves roosted here and that they flew in here whenever disturbed. Adjoining was a field of buckwheat where they were in the habit of feeding. The infection or center was entirely on a tract of less than one-fourth acre in size and the trees were nearly all thoroughly infected, mostly in the tops. Several trees showed persistent leaves in the tops, but otherwise there were no signs of the blight. Upon climbing these trees the first stages of the blight were found in a slight splitting of the bark together with a few pustules just beginning to become visible. It seems likely, therefore, to suppose that this infection was carried here by these birds, or at least that it was spread locally by them to other centers near at hand. In all nearly 400 trees were found to be infected, and these were found grouped in six or eight centers. Very effective co-operation is being given the Commission by the owners of these tracts in this region. However, there is a solid strip of chestnut timber four to five miles wide and eight to ten miles long, stretching from the Ogdonia down the Loyalsock Creek. It will be impracticable to attempt to scout this region this winter, but with the opening up of spring, by placing a

crew of four or five men in here under the direction of a man familiar with the territory, the whole region will be carefully scouted.

All known infections will be destroyed and the men working in this territory cutting tannery wood, are thoroughly familiar with the appearance, spread, and danger of the disease, so that we can look for local assistance, and that in the end is the aim of our work.

In conclusion, taking everything into consideration, good results have been obtained by winter work. Persistent leaves are visible to a trained eye for long distances through the woods. However, deep snow or a covering of sleet interferes with the finding of pustules at the base of the tree. Their dying branches begin to show most prominently during late summer, hence August and early September is the ideal time for scouting work.

The strip along the river actually inspected contains 452 acres, and this was covered in about a month of actual inspection, for considerable time was used up in superintending the removal of infected trees.

A fair estimate is 4 acres per day per man for a close inspection, working the tract in 50 feet strips. In a very close tree to tree winter inspection, two men can cover four to five acres or two to two and a half acres per day per man.

LONGEVITY OF LIFE OF SPORES.

The following report is submitted in response to the request of Mr. E. A. Weimer, that an attempt be made to germinate spores from an infected piece of chestnut, collected in Monroe county in July, 1908, and continuously kept in a moist cell at the Department of Forestry since that date. Forty-four months after the time of collecting, the status of the fungus is found to be as below:

"Philadelphia, April 19, 1912.

Mr. I. C. Williams,

Deputy Commissioner of Forestry,
Harrisburg, Pa.

Dear Mr. Williams: In reply to your letter of April 18, I can give you the following report:

The fungus on your specimen made a small growth as I at first reported to you. After however, it had started to produce a small number of picnidia it ceased to grow. I then began again, and found that I could cause the spores to germinate. They in turn made but a small growth, and afterward were unable to produce any fruiting picnidia. A small part of the bark which I removed from your specimen was put in a damp chamber. I was unable to get any growth at all from this. This shows that the specimen has almost lost life. This loss of vitality may be due to the Penicillium, a fungus which has covered the surface of this specimen. I will return the specimen in the bottle to you at once.

Very truly yours,

(Signed) CAROLINE RUMBOLD."

REGISTERED DELEGATES AND GUESTS.

The following names and addresses appear on the official register of delegates and guests in attendance at the Conference. It is a matter of regret that a large number of those in attendance failed to register, although indicating their active interest by their presence at one or more sessions.

Daniel Adams, 301 Crozier Bldg., Philadelphia, Pa., (Lumbermen's Ex.)
Prof. Geo. G. Atwood, Albany, N. Y.
Dr. J. M. Backenstoe, Emaus, Pa.
Prof. H. P. Baker, Forester, State College, Pa.
Parker Thayer Barnes, Harrisburg, Pa.
Prof. Geo. L. Barrus, Albany, N. Y.

H. H. Bechtel, Cincinnati, Ohio.
George Bell, Marysville, Pa.
F. W. Besley, John Hopkins Univ., Baltimore, Md.
John Birkinbine, Philadelphia, Pa.
W. F. Blair, Waynesburg, Pa.
Rep. Bloodgood Nurseries, Flushing, N. Y.
Samuel T. Bodine, Villa Nova, Pa.
John Y. Boyd, 222 Market St., Harrisburg, Pa.
H. F. Bright, Ashland, Pa.
H. R. Bristol, Plattsburg, N. Y.
Wm. McC. Brown, Oakland, Md.
Henry G. Bryant, 2013 Walnut St., Phila.,
Geo. H. Campbell, B. & O. R. R., Baltimore, Md.
Chester E. Child, Pres. Lumber Mfrs. Assn., Putman, Conn
Prof. W. D. Clark, State College, Pa.
Dr. Geo. P. Clinton, Conn. Agr. Exp't. Station, New Haven, Conn
S. C. Clemons, 431 Dearborn St., Chicago, Ill.
B. F. Cocklin, Mechanicsburg, R. F. D., No. 2, Cumb. Co., Pa.
Prof. J. Franklin Collins, Washington, D. C.
W. G. Conklin, Troxelville, Pa.
Hon. Robert S. Conklin, Commissioner of Forestry, Harrisburg, Pa
Dr. M. T. Cook, New Brunswick, N. J.
W. C. Coombe, Millerstown, Pa.
Geo. F. Craig, Rosemont, Pa.
J. C. Cramner, Lehigh University, South Bethlehem, Pa.
Hon. J. W. Crawford, North Bend, Pa.
H. W. Crawford, Conestoga Traction Co., Lancaster, Pa.
W. A. Crawford, Cooperstown, Pa.
Hon. Wm. T. Creasy, Master State Grange, Catawissa, Pa.
Hon. N. B. Critchfield, Secy. or Agriculture, Harrisburg, Pa.
S. L. Cummings, Dewart, Northumberland Co., Pa.
Prof. Nelson Fithian Davis, Bucknell University, Lewisburg, Pa.
Jos. W. Derrick, care of Harison Townsend, 10th and Chestnut, Phila.
S. B. Detwiler, Executive Officer, C. B. Comm'n., Bala, Pa.
Mrs. S. B. Detwiler, Bala, Pa.
Dr. Samuel G. Dixon, State Health Comm'r., 1900 Race St., Phila.
Dr. Henry S. Drinker, Pres. Lehigh University, South Bethlehem, Pa.
Hon. John J. Dunn, Board of Agriculture, Providence, R. I.
S. B. Elliott, Reynoldsville, Pa.
Elwanger & Bro., Pottstown, Pa.
Dr. J. B. Emerson, 40 E. 41st St., New York City.
S. B. Enterline, Pottsville, Pa.
Samuel L. Eslinger, Lemoyne, Cumb. Co., Pa.
J. K. Esser, Field Agt. Chestnut Tree Blight Comm., Mauch Chunk, Pa.
Thomas Evans, Lebanon, Pa.
Hon. A. B. Farquhar, Pres. Penna. Conservation Asso., York, Pa.
P. S. Fenstermacher, Supt. Trexler Farms, Allentown, Pa.
F. R. Fertig, State Horticultural Inspector, Lebanon, Pa.
Rep. F. & F. Nurseries, Springfield, N. J.
F. W. Finger, Philadelhpia, Pa.
W. Righter Fisher, Bryn Mawr, Pa.
Dr. Wm. R. Fisher, Swiftwater, Pa.
J. W. Fisher, Newport, Tenn.

Dr. A. K. Fisher, Bureau of Biological Survey, Washington, D. C.
Amos Fleisher, Newport, Pa.
P. Hartman Fox, Austin, Pa.
James G. Fox, Hummelstown, Pa.
W. W. Frazier, 250 S. 18th St., Philadelphia, Pa.
Thomas E. Francis, Field Agt. C. T. B. Comm'n., Huntingdon, Pa.
Prof. H. R. Fulton, State College, Pa.
Blair Funk, Pequea Creek, Pa.
W. H. Gardner, Basic City, Va.
Samuel R. Gault, Harrisburg, Pa.
Dr. N. J. Giddings, Morgantown, W. Va.
J. M. Goodloe, Bigstone Gap, Va.
C. E. Gosline, Paterson, N. J.
Prof. Arthur H. Graves, Yale University, New Haven, Conn.
E. M. Green, Mt. Union Tanning and Extract Co., Mt. Union, Pa.
W. E. Grove, York Springs, Pa.
Melvin Guptill, Malden, Mass.
Dr. H. T. Gussow, Ottawa, Canada.
Miss Mary M. Haines, Cheltenham, Pa.
Robert B. Haines Co., Cheltenham, Pa.
Robert W. Hall, Lehigh University, South Bethlehem, Pa.
James L. Hamill, Columbus, Ohio.
J. Linn Harris, Bellefonte, Pa.
Dr. J. W. Harshberger, 4839 Walton Ave., Philadelphia, Pa.
D. S. Hartline, Bloomsburg, Pa.
W. Elmer Houpt, Shippensburg, Pa.
Henry Hawk, 903 16th Avenue, Altoona, Pa.
L. E. Hess, Berwick, Pa.
John K. Hibbs, Field Agt. C. T. B. Comm'n., Philadelphia.
Dr. Samuel S. Hill, Supt. Chronic Insane Asylum, Wernersville, Pa.
G. H. Hollister, Hartford, Conn.
J. E. Holme, care of England, Walton Co., 3rd and Vine, Phila.
E. A. Hoopes, Moylan, Pa.
Dr. A. D. Hopkins, Bureau of Entomology, Washington, D. C.
John Hosfeld, Shippensburg, Pa.
Hon. Josiah Howard, Emporium, Pa.
Geo. G. Hutchinson, Warrior's Mark, Pa.
F. B. Jewett, Brooklyn, Pa.
Henry C. Johnson & Co., Luzerne, Pa.
Joseph Johnston, 3940, Lancaster Ave., Phila.
Miss Florence M. Jones, Philadelphia, Pa.
Miss Martha Jones, Conshohocken, Pa.
Hon. George B. Keezell, Keezeltown, Va.
George W. Kehr, Pa. State Branch Nat. Con. Asso., Harrisburg.
George A. Kerr, care of John H. Heald & Co., Lynchburg, Va.
W. S. W. Kirby, Philadelphia, Pa.
Theodore Klein, Ariel, Pa.
William Kline, West Hanover, Pa.
H. C. Klinger, Liverpool, Pa.
Q. U. S. Krody, Lancaster, Pa.
J. Landis, Bunker Hill, W. Va.
W. J. Lawson, Andora Nurseries, Chestnut Hill, Pa.
Chas. E. Lewis, Orono, Maine.

Edw. Lienhard, Mauch Chunk, Pa.
K. Lockwood, State Chemist, New York City.
Hon. Amos F. Lunn, State Senate, No. Smithfield, R. I.
Lindley R. Lynch, Providence, R. I.
Garfield McAllister, Harrisburg, Pa.
Prof. Chas. A. McCue, Dover, Del.
John McNabb, Howard Estate, Lower Merion, Pa.
James E. McNeal, Lancaster, Pa.
Miss M. A. Maffet, 264 S. Franklin St., Wilkes-Barre, Pa.
E. Mather, Harrisburg, Pa.
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W. E. Merriman, Narrows, Va.
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PENNSYLVANIA CHESTNUT TREE BLIGHT COMMISSION.
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TREATMENT OF ORNAMENTAL

CHESTNUT TREES

AFFECTED WITH

THE BLIGHT DISEASE

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1912.

Pennsylvania Chestnut Tree Blight Commission.

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NOTE.

The Commission for the Investigation and Control of the Chestnut Tree Blight Disease in Pennsylvania was authorized by an Act of Assembly approved by Governor Tener, June 14, 1911.

This Commission, in collaboration with the Pennsylvania Department of Forestry, is to ascertain, determine upon and adopt the most efficient and practicable means for the prevention, control and eradication of a disease of the chestnut tree, commonly known as the chestnut tree blight. It is authorized to conduct scientific investigations into the nature and cause of such disease, and the means of preventing its introduction, continuance and further spread. The Commission has power to establish, regulate, maintain and enforce quarantine against the introduction and spread of such disease, and from time to time, to adopt and prescribe such regulations and methods of procedure as it may deem necessary and proper.

The Commission will cooperate with the owners of chestnut trees to accomplish all of the purposes of the Act in every possible manner.

TREATMENT OF ORNAMENTAL CHESTNUT TREES AFFECTED WITH THE BLIGHT DISEASE.

This bulletin is intended as a guide for the treatment of individual chestnut trees affected with blight, which on account of their value as orchard trees or for decorative purposes warrant the expenditure of considerable time and money for their preservation.

DESCRIPTION OF THE DISEASE

The blight disease is caused by a fungus which grows in the bark and also in the outer layers of sapwood. Pustules (fruiting bodies) are soon produced and grow through to the surface of the bark. On old, rough-barked trees these pustules are borne in the crevices of the bark. The pustules, of a pinhead form, are orange-yellow or saffron in color, and get darker with age, at maturity being a rusty brown. The spores are of two kinds and are produced at nearly all seasons of the year. They are disseminated through the agency of wind, insects, birds, etc. The spores must reach the inner or middle bark to cause an infection. Ordinarily they germinate very quickly, perhaps in a few hours, or at most in a few days. The mycelium then grows through the bark in all directions, developing a series of more or less concentric rings, so that the lesion, or area of infection, has a somewhat circular or oval shape. The rate of growth of the mycelium depends upon weather and other conditions. It grows at all seasons of the year, except in the coldest weather, when it is dormant. In summer, especially in June and July, it is most rapid, as a temperature of about 70 degrees and upwards seems best suited for its development, but growth is less rapid if the weather is dry. In July and August the trees bearing dead branches are especially noticeable.

FAKE REMEDIES

A great number of so called "cures" for the blight have been advanced. In many cases the method of treatment shows that the sponsor is either ignorant or unscrupulous, and in other cases the work is done in such a haphazard fashion that it is entirely worthless.

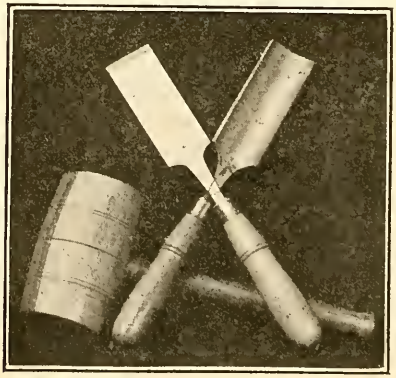
A spray cannot penetrate beneath the bark where the disease is working, and consequently is absolutely worthless as a remedy. It may be possible, however, to find a toxic solution which can be introduced in some way into the circulation of the tree which will kill the fungus without killing the tree. The Pennsylvania Chestnut Tree Blight Commission is carrying on a series of experiments with this end in view, and it is hoped that some such remedy will be found. It has been claimed that a proper application of fertilizers will cure the disease. While it may be that a healthy, rapidly

growing tree is more resistant, observations seem to prove that soil fertilization alone is not a cure. The principal remedies and treatments advocated are being given a thorough test by this Commission, and should any of them be found successful, the public will be so informed. At the present time, however, we can recommend nothing but the treatment herein outlined, which will have to be carried out thoroughly if any considerable degree of success is to be attained.

The work can be done by the owner himself in some cases, especially if the trees are small or easily climbed. A good working knowledge of the characteristics of the disease is essential, but the owner can be sure when he does the work himself that the proper precautions are taken. The owner should also make numerous examinations after the first treatment is concluded, and should be in a position to remove the incipent infections, when this can be done cheaply and before the trees are much harmed.

TREATMENT

The treatment consists principally in cutting away the infected portions of the tree. The mycelium quickly discolors the bark and a sharp line between the apparently healthy and infected bark is usually seen. However, the mycelium penetrates into the apparently healthy bark, and if possible, the cut should be made one inch or more beyond the discolored area. The mycelium also works to some extent into the sapwood below the discolored area, and three or more annual layers of wood should be removed as well. The smaller infected branches should be cut off one foot or more below the canker, when possible. If these branches are cut off at the base, flush with the tree, the wound will heal over more quickly, and there is less danger of the trees becoming reinfected. If the infection lies near the base of a branch, care should be taken to see if any of the mycelium has grown into the trunk. A gouge, chisel and mallet are the proper tools for use in such work. The gouge should be kept very sharp, so that the tissues at the edge of the cut are not unnecessarily bruised, and the healing over of the wound thus delayed. With good work the new growth will start directly under the cut and will often be visible in less than a week, in the actively growing season. The new growth takes place at the sides of the wound. Often above and below a broad



Three handy tools in tree surgery.

wound a triangular piece of bark will die. For this reason it is advisable that the top and bottom of the scar be pointed rather than abrupt or broadly rounded. A large percentage of the bark of a vigorous, young tree can be removed if necessary, without killing the tree. Portions can be cut away from all sides, and the flow of sap will alter its course so as to follow the living bark. It has been shown that this flow of sap under extraordinary conditions will deviate from a longitudinal course fully 90 degrees.

The wounds should be painted with an antiseptic covering after all traces of the mycelium are removed. This is to prevent the development of insect or fungous diseases, as well as the infection by spores of the blight which may have lodged upon the wound, and also to act as a waterproof covering for the wound. Very thick coal tar diluted with creosote to make it readily applicable is the best combined antiseptic and cover that can be recommended and should be used wherever possible. Other substances which can be used as antiseptics only are:

Corrosive sublimate (bichoride of mercury), in the proportion of one part of the corrosive sublimate to one thousand parts of water. Tablets of this poison are sold at all drug stores with directions as to how much water to add to make the 1-1000 solution.

Formalin, 5% solution in water. This is also a poison and must be used with care.

Either of the above antiseptics will kill any of the fungus with which they come in contact. The cutting tools need not be dipped in any solution to kill any spores which may adhere to them, provided the antiseptic is immediately and carefully applied to all cut surfaces.

Waterproof coverings to follow as soon as antiseptic is dry:

1. Coal tar.
2. Lead paint.
3. Shellac, (of temporary value only unless renewed often).

Or this Solution:

4. 1 gallon pine tar.
   2 qts. rosin.
   1 qt. linseed oil. Mix thoroughly.

Extreme care should be taken to collect and burn every particle of the wood and bark which was cut from the infected parts of the tree. This is important. The fungus will live in this bark for a long time after being cut. It has been found that pieces of bark cut from trees send out living spores after lying on the ground in all kinds of weather for five months, and that fence rails and un-

barked logs used for building purposes have still shown the disease in an active condition after a year or more. All underbrush, etc., should be cleared from around the tree and the entire tree and the ground directly under it sprayed with a lime-sulphur wash or other disinfectant.

After the treatment has been completed, there is danger from two sources:—1. Some of the mycelium may have been overlooked and left in the bark or wood. The edges of the wound should be closely watched for sometime after the first treatment, and if re-infected, should be promptly and more thoroughly cut away again. Unless this is done it will be unwise or useless to spend money for the first treatment. 2. The tree must be guarded against new infection. For this reason if the tree is located in a region where the disease is very prevalent, or if the tree is in an unhealthy condition and presents many wounds which serve as entrances for spores, the chances for success are smaller. All wounds should be covered during the first treatment and every precaution taken to prevent unnecessary wounds. The use of climbing irons on trees results in the most dangerous type of wounds, and their use by any so-called "tree doctors" should be sufficient reason for branding the men as incompetent, ignorant or wilfully careless.

Spraying the trees at intervals for the purpose of preventing re-infection will kill spores on the exterior and may be successful. Lime-sulphur or Bordeaux mixture may be used, and the work should be done at intervals of about two (2) weeks during the spring and summer, and, if possible, through the entire year.* Painting or spraying the trunk and larger limbs with whitewash is also of some apparent benefit, so far as tried. It is also advisable to apply a coating of tree varnish or tree tangle-foot to the base of the trees after spraying, to keep crawling insects off of the trees.

CASES WHERE THERE IS SMALL CHANCE OF SUCCESSFUL TREATMENT

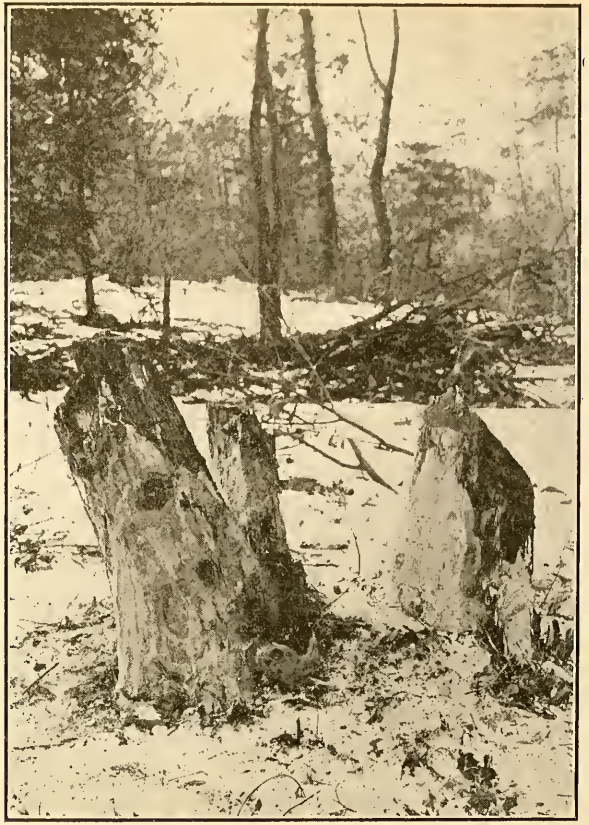
No such treatment can be recommended for forest trees on account of the difficulty and expense attached to it. Even in the treatment of orchard and lawn trees there is less likelihood of success than usual in such instances as the following:

1. When the tree is very old or very large. Trees in time lose their power of recuperation, and the wounds made in the course of the work will not heal over readily. Experience has shown that trees over forty feet high are seldom treated with any beneficial results.

2. Where the disease has progressed over a large portion of the trunk of the tree so that much of the bark will have to be removed. If the trunk or a large branch is nearly girdled, the

*Complete and detailed directions for making Bordeaux Mixture and Lime-Sulphur solutions will be found in Farmers' Bulletin No. 243, which can be obtained free upon application to the Secretary of Agriculture, Washington, D. C.

Bark and refuse material piled on infected stump for burning.



Chestnut stump after burning; sprouts will develop quickly.

treatment is apt to seriously weaken the tree. Before the work begins, a careful inspection of the diseased areas should be made. Begin at the base and thoroughly examine all portions to the tips of the branches, for signs of blight unless the base is badly diseased, when it will be useless to attempt to save the tree.

3. When the tree is in an unhealthy condition, due to borers or wood rotting fungi. Trees having borer holes and bark wounds present entrances for more spores of the blight and do not respond to the treatment.

4. In localities where the blight is very prevalent and where little is being done to fight it. There is little hope of saving a tree when there are many trees in the vicinity producing millions of spores.

FERTILIZERS

It is believed that a healthy, rapidly growing tree is less liable to infection and will certainly recover better under treatment. It is advisable to apply a fertilizer to the soil about the tree. The soil should be treated a few feet further than is covered by the spread of the crown of the tree. The fertilizer to be applied should contain all the chemical elements in which the soil is deficient—nitrogen, phosphorus, and potash are the most likely to be absent from or deficient in the soil. A mixture of these three is advisable. The following formula, which contains these three elements in readily soluble form, is suggested:

Per 100 square feet:

4 oz. muriate potash	(Potash-content 50%)
13 oz. nitrate soda	(Nitrogen-content 15%)
14 oz. acid phosphate	(Phosphorus-content 14%)

Per Acre

100 lbs. muriate potash (50%)
330 " nitrate of soda (15%)
350 " acid phosphate (14%)

It has also been suggested that an alkaline condition of the soil may have some favorable influence in checking the blight. As a remedy, lump (fresh burned) lime should be used, in quantities of about 9 lbs. per 100 square feet, or two (2) tons per acre. If used with the above fertilizer, it should be applied either two weeks before or after—not at the same time.

SUSCEPTIBILITY AND IMMUNITY

All wild and cultivated varieties of American and European chestnuts seem to be susceptible to the blight, but not all to the same degree. So far as can be ascertained, pure strains of Chinese, Japanese and Korean chestnuts seem to be almost, if not quite,

immune to the blight. This applies, however, only to trees grown from imported nuts or nursery stock. These trees hybridize very readily with the native trees, and trees grown from seed produced in this country appear to lose their power of immunity.

RECOGNIZING THE DISEASE

Owners of valuable chestnut trees in Pennsylvania should learn at once to recognize all the symptoms of the blight, so that it may be speedily detected as soon as it appears.

Briefly stated, the disease may be located and recognized by some or all of the following characteristics:

1. Dead branches, usually with withered leaves clinging to them. In the spring, prior to death, the leaves on the infected branches remain small and sickly looking, and gradually take on a yellowish tinge. When these leaves finally die, they have a peculiar wilted appearance. The burrs also remain small and undeveloped. On branches attacked after the leaves have fully developed, the leaves assume their yellowish or reddish-brown fall colors. On trees killed by blight during the growing season prior to September, both leaves and burrs usually remain clinging to the branches through the following winter and are of great value in helping to locate infected trees. All dead branches should be closely examined for further indications of the disease, particularly at the base of the dead parts.

2. Cankers on diseased branches or the trunk, where the bark is not thick and rough. These cankers are areas of dead, discolored, sunken bark, often more or less broken by cracks or checks into the inner bark. Old, thick bark does not change in outward appearance until a year or so after it is diseased, when it begins to peel from the tree in shreds. Prior to shredding, thick bark which is affected gives forth a peculiar hollow sound when struck with a hammer, due to a space between the wood and bark caused by the decay of the inner bark.

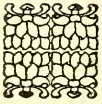
3. Small reddish blisters appear on cankers on smooth bark. Later the tops of these blisters burst, forming small, wartlike eruptions or pustules of a sulphur-yellow, orange, or brown color. In the deep cracks of old bark, the pustules form reddish or orange-colored lines. These pustules are the fruiting bodies which produce the spores. During damp weather bright yellow, twisted threads of the microscopic spores are sent out from the pustules. These threads are jelly-like at first but on drying become firm and brittle. They vary from one-sixteenth to half an inch in length, and are dissolved by the rain, which distributes the spores down the surface of the bark.

The mycelium or vegetative portion of the fungus shows in small, irregular, fan-shaped areas of yellowish or buff color, when the surface of diseased bark is shaved off or cut slantwise. This is the portion which produces the spore-bearing pustules, and also the part that saps the life of the bark.

5. Death of tops of entire trees. These dead trees are often conspicuous because of the reddish-brown patches of bark, due to the presence of the pustules. In case the tree has been dead for a year or more, the bark begins to peel off naturally in strips or shreds.

6. Suckers or water sprouts, which develop at the base of the cankers or at the base of the diseased tree. They are frequently very numerous for one or two seasons, after which they are usually killed by the fungus.

If in doubt as to the existence of blight in your locality, communicate with the Chestnut Tree Blight Commision, 1112 Morris Building, Philadelphia, supplying all information of importance concerning the matter.



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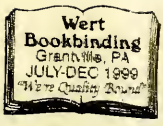
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